ROSS METALS
SUPERFUND SITE

RECORD OF DECISION

April 2, 1999

U.S. Environmental Protection Agency
Region 4

RECORD OF DECISION

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1.0 DECLARATION

SITE NAME AND LOCATION

Ross Metals, Operable Unit #1
100 North Railroad Street
Rossville, Fayette County, Tennessee

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Ross Metals Site, Operable Unit #1, in Rossville, Fayette County, Tennessee. This action is chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the Administrative Record for this Site.

The State of Tennessee concurs with the Selected Remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This operable unit is the first action of at least two operable units that are planned for the Site.

This operable unit remedy addresses source materials (soil, sediment, waste, pavement, and debris) through treatment and off-Site disposal of principal and low-level threat wastes.

The major components of the remedy include:

- Decontamination, demolition, and off-Site disposal of pavement and buildings with recycling of metal debris;
- Excavation of contaminated soil, landfilled slag, and contaminated sediment with appropriate confirmation sampling;
- Backfill of excavated subsurface-soil areas and landfill with clean soil;
- Stabilization/solidification/fixation of contaminated soil, stockpiled slag, landfilled slag, and wetlands sediment;

- Off-Site disposal of soils, slag and sediment at a RCRA-nonhazardous waste disposal facility;

- Application of a layer of biosolids over the Site. Grass seeding of the facility and landfill areas; and revegetation of the Site wetlands according to the wetlands revegetation plan developed by EPA, 1998.

- Development of a maintenance and monitoring plan to assess the effectiveness of the cleanup action.

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies, to the maximum extent practicable for the Site. This Remedy satisfies the statutory preference for treatment as a principal element.

Because this Remedy will not result in hazardous substances remaining on-Site above health-based levels that allow for unlimited use and unrestricted exposure, a five-year review will not be required for this remedial action.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the *Decision Summary* section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of Concern (COCs) and their respective concentrations;
- Baseline risk represented by the COCs;
- Cleanup levels established for COCs and the basis for the levels;
- Current and future land and ground-water use assumptions used in the baseline risk assessment and ROD;
- Land use that will be available at the Site as a result of the Selected Remedy;
- Estimated capital, operation and maintenance O&M), and total present worth costs; discount rate; and the number of years over which the Remedy cost estimates are projected; and
- Decisive factors that led to selecting the Remedy (i.e., description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria).

Date

Richard D. Green, Director
Waste Management Division

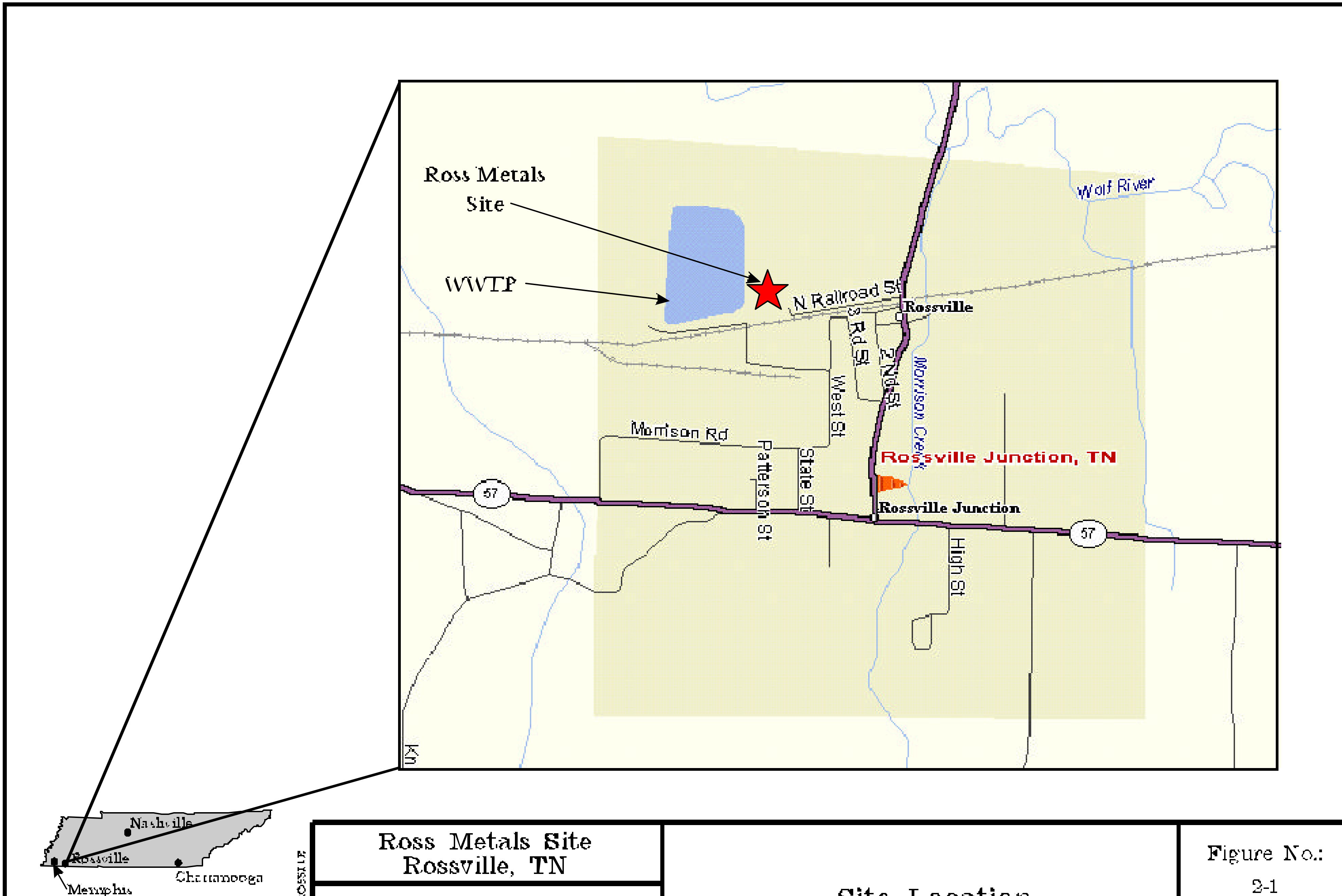
2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The RM facility is located at 100 North Railroad Street in Rossville, Fayette County, Tennessee, (see **Figure 2-1**). The facility's geographic coordinates are 35° 02' 57" North latitude and 89° 32' 55" West longitude, as shown on the U.S. Geological Survey (USGS) topographic map quadrangle for Rossville, Tennessee (U.S. Geological Survey [USGS] 1965). The Site includes contaminated wetlands to the north and northeast of the process area and the landfill. It is bordered by residential property to the east, the Southern Railroad tracks to the south, and a municipal wastewater treatment plant to the west. A Site layout is presented in **Figure 2-2**.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

From 1978 until June 20, 1992, RM operated a secondary lead smelter at the Site. Prior to 1978, the property was undeveloped. RM produced specification alloyed lead that was sold for use in manufacturing vehicle batteries, lead shot pellets, and sheet lead (radiation shields) (Ogden Environmental Energy Services Company [Ogden] 1994). The facility received spent lead acid batteries, spent lead plates, lead oxide, scrap metal, and other lead waste and material from various businesses and industries, including battery crackers and battery manufacturers. The primary material used for the recycling process was spent lead acid batteries, with automotive and industrial batteries accounting for 80 percent of the raw material processed. The remaining 20 percent consisted of other lead-bearing materials, such as recycled dross, dust slag, and factory scrap. Facility operations included not only the smelting of lead and other scrap metals but a variety of other products, such as crushed drums, limestone, steel, and cast iron. These materials were added to the blast furnace as flux to create a reducing atmosphere. Wastes generated from the process included slag, plastic chips, waste acid, lead emission control dusts, and lead-contaminated stormwater (Black & Veach Waste Science, Inc. [B&V] 1996).



Not to Scale

Ross Metals Site Rossville, TN	Site Location	Figure No.: 2-1
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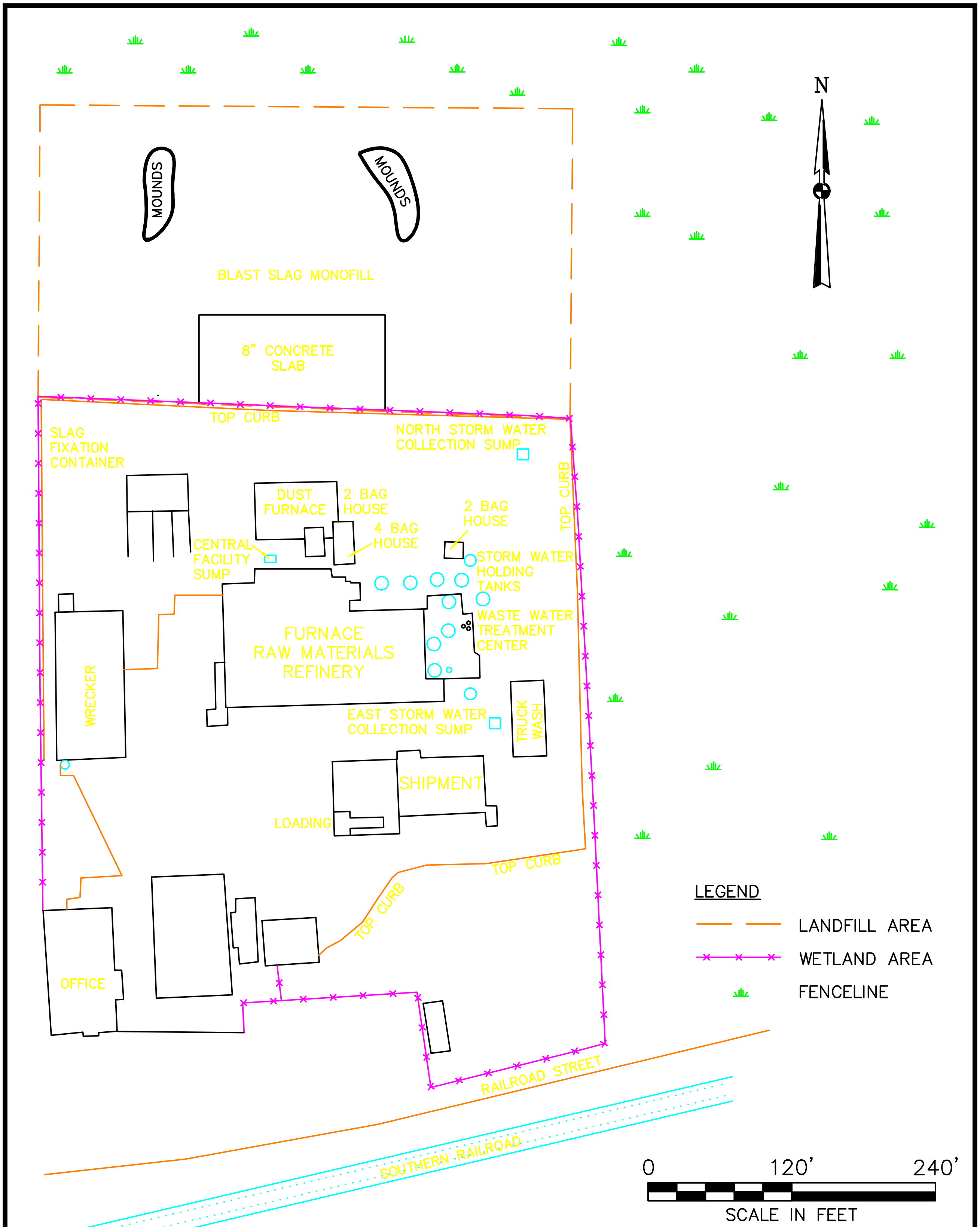

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Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
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Site Layout

Figure No. 2-2

7/98

Upon receipt, batteries were stored on pallets located east and southeast of the facility; each pallet held about 50 batteries. The batteries were then conveyed to the wrecker building for the battery breaking operation. Wastewater used for battery breaking operations conducted inside the wrecker building was managed by an on-Site wastewater treatment system. Water was used to separate lead from other battery components based on its density. After separation, lead was transported to the blast furnace slag area, where lead materials were passed through a smelter. According to facility representatives, 99 to 99.5 percent of the lead content was recovered. The molten lead product was then moved to the refinery area. The refinery area consisted of four kettles that received molten lead and formed ingots. The ingots were then moved to the finished storage area until they were shipped to customers (B&V 1996).

Acid and sludge obtained during the battery breaking operation contained residual amounts of lead and lead acid; the acid and sludge were transferred to the wastewater treatment unit to reclaim the remaining lead. Lead was reclaimed by allowing it to settle further in aboveground collection tanks. This lead sludge, collected prior to neutralization, was transferred to the blast furnace area and immediately fed into the furnace. The remaining acid was neutralized with liquid caustic soda. Upon neutralization, the solution was held for additional settling to precipitate dissolved metals. Sludge resulting from the neutralization process was also collected in settling tanks and recycled into the blast furnace with other lead scrap. The pH of the waste stream generated by the facility was further adjusted, and sludge-free effluent was discharged to the Rossville Municipal Sewage Treatment Facility (Tibbels 1983).

Several areas of the operating facility contained large volumes of lead-bearing materials. With the exception of the container storage area, the lead-bearing materials were not containerized; instead, they were placed on the asphalt foundation of the facility or directly on facility soils.

From 1979 until December 1988, blast slag that had accumulated as a part of the smelting process was disposed of in an on-Site landfill. On November 3, 1986, RM submitted a petition for registration for an existing industrial landfill used to dispose of blast furnace slag; RM considered the slag a nonhazardous industrial waste. On November 8, 1988, RM submitted a RCRA Part B application stating that slag had been deposited on Site. Diagrams included in the application show slag piles both inside and outside of the area designated as the landfill. EPA's RCRA Compliance Section conducted a sampling investigation on December 7, 1988, to determine if the waste generated at the facility should be regulated. On December 20, 1988, the Tennessee Department of Health and Environment (TDHE) suspended all further processing of the request until results from the EPA sampling event could be assessed and the EPA could determine whether the blast slag was a nonhazardous waste (B&V 1996). Several references in the EPA files for the RM Site debate the status of blast slag as a hazardous waste. File material also indicates that on April 20, 1990, RM applied for a solid waste classification variance for the blast slag. RCRA also conducted a sampling investigation on May 9, 1990, to determine if smelting and landfilling activities at the facility were causing adverse environmental impacts. The variance was denied on June 6, 1990, because EPA determined that blast slag was a hazardous waste and subject to the full extent of RCRA regulations.

In September of 1990, RCRA issued a Complaint and Compliance Order against Ross Metals. After several months of extensive negotiations, the parties reached an agreement to settle the case. However, the company never signed the Consent Agreement, because of its precarious financial condition. In 1992, Ross Metals, Inc. received an Administrative Dissolution under Articles of Incorporation. There is no known successor entity. Because of this, all State and Federal RCRA enforcement actions at the Site ceased.

Once negotiations failed with Ross Metals and all operations ceased at the facility, the Site was referred to EPA's ERRB. In a letter dated October 25, 1993, ERRB notified TDEC that the Site was eligible for a removal action. Prior to any ERRB clean-up activities, TDEC was approached by an interested third party, Greyhound Finance Services (GFS), regarding the possible clean-up of the Site. EPA and TDEC decided a State Lead RCRA Closure performed by GFS would be beneficial to all parties. An agreement concerning the RCRA Closure was never reached, therefore the Site was referred back to ERRB in June of 1994.

On June 15, 1994, ERRB conducted a Site visit. Based upon ERRB's file review and Site visit, the Ross Metals Site met the criteria for a high priority removal action. The removal action began in September 1994 and was completed in June 1995. The removal consisted of segregating, staging, or removing forty-six wastestreams. The wastestreams, descriptions, and approximate volumes of each is listed in the **Tables 2-1 and 2-2.**

Approximately 6,000 cubic yards (CY) of lead bearing blast slag was staged in on-Site buildings. The removal action was completed in August 1995. During the removal action, EPA was also conducting a Site investigation for the NPL listing process. In October 1996, the North Site Management Branch began remedial investigations. The Site was listed on the final National Priorities List March 31, 1997.

An Engineering Evaluation/Cost Analysis (EE/CA) was finalized in February 1998. In considering the information presented in the EE/CA and the statutory limits which apply to non-time critical removal actions, EPA determined that a Remedial Investigation/Feasibility Study Report that develops appropriate remedial action alternatives was needed for this Site.

On March 24th, 1998, EPA sent general notice letters to the Potentially Responsible Parties (PRPs).

The threat of human exposure and reports of trespassing caused EPA to perform a removal action in June and September of 1998. About 10,000 CY of slag are landfilled in an unlined and unsecured area located just north of the facility process area. About 6,000 CY of stockpiled lead slag material are still stored at the facility inside deteriorating sheet metal buildings. The buildings are no longer

Table 2-1
Non-Hazardous Waste Removed Offsite

Quantity Removed	Dates Removed	Type of Waste Removed	Type of Disposal Facility
Not Applicable	9/26 - 10/10/94	battery cracking equipment; ingot casting conveyor, baghouse blower, 17 colling crucibles, battery saw, conveyor belt, tumbler and associated framework.	Reclamation Facility
230 cubic yards	10/3 - 12/20/94	construction-type debris	Landfill
2 each	10/21/94	baghouses	Reclamation Facility
371 gallons	10/25/94	diesel fuel	Reclamation Facility

Table 2-1 Non-Hazardous Waste Removed Offsite			
Quantity Removed	**Dates Removed**	**Type of Waste Removed**	**Type of Disposal Facility**
Not Applicable	10/31/94	baghouse equipment: baghouse frame and associated ductwork, screen	Reclamation Facility
850 cubic yards	11/05 - 11/18/94	conveyor, cross members, catwalk and ladder, scrap metal	Recycling Facility
88 containers	11/11/94	laboratory chemicals	Facility Local
20 cubic yards	11/30/94	old tires	High School Local
17 cubic yards	12/12/94	soda ash	Landfill Recycling Facility

Table 2-2 Hazardous Waste Removed Offsite			
Quantity Removed	**Dates Removed**	**Type of Waste Removed**	**Type of Disposal Facility**
250 cubic yards	11/14 - 11/15/94	battery chips/leaded debris	Regional TSDF
34,430 lbs	12/02 - 12/12/94	leaded tank sludges ((D008,D006)	Local TSDF
288 cubic yards	12/08 - 12/19/94	leaded debris; debris, soil, floor dust, rags, PPE, cinderblocks (D008)	Regional TSDF

307,220 lbs	12/12 - 12/21/94	raw materials (K069,D008)	Reclamation Facility
330 gallons	12/16/94	base-neutral liquid	Local TSDF
330 gallons	12/16/94	motor oil	Local TSDF
90 gallons	12/16/94	hydrochloric acid	Local TSDF
110 gallons	12/16/94	sodium hydroxide	Local TSDF
3500 gallons	12/16/94	sodium hydroxide	Local TSDF

providing protection from weather conditions because of deterioration. Data collected in the investigation revealed lead-contaminated surface soils (outside the fenced facility - approximately 8.58 acres). This area is adjacent to residential property and is located within a designated wetland. The removal action consisted of placing tarpaulins over the 6,000 CY of stockpiled lead slag and installing security fencing around the contaminated surface soils and landfill.

The Remedial Investigation/Feasibility Study was finalized in November 1998

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Local officials have said that area residents have been fairly quiet about the presence of an NPL Site in the community. A Fayette County Health Department representative said they have received very few questions regarding health concerns.

A Fact Sheet was issued January 1997, prior to a Public Availability Session, which was conducted by EPA and the Tennessee Department of Environment and Conservation. The Availability Session was conducted January 6, 1997. No citizens attended.

A fact sheet was released immediately after the Site was placed on the NPL. The Site was placed on the NPL on March 31, 1997.

The Agency for Toxic Substances and Disease Registry (ATSDR), after reviewing the available environmental data suggested that people were possibly exposed to metals in on-Site and off-Site surface soils and water. Therefore, ATSDR decided to conduct an Exposure Investigation (EI) to determine the lead level present in the soil of the adjacent residences and offered blood-lead level testing to the residents adjacent to the Site. The EI also included soil and dust testing for lead in residential areas. The EI conducted was to investigate a possible public health problem and develop plans for its control.

Following the issuance of notices to Potentially Responsible Parties (PRPs), EPA held an informational public meeting on April 14, 1998. During that meeting, citizens were encouraged to form a Community Advisory Group (CAG).

ATSDR held a community meeting with residents of Railroad Street to explain the purpose of the EI on April 21, 1998. Prior to the community meeting, ATSDR distributed flyers throughout the community and coordinated media outreach with local newspapers in the area. In conjunction with the Tennessee Department of Environment and Conservation, ATSDR collected blood, soil and wipe samples from identified residents on May 30, 1998.

The Rossville CAG, composed of approximately 10 citizens, met for the first time in May 1998. The CAG meets the first Tuesday of each month, as needed. Their mission statement is "The Rossville Community Advisory Group exists to insure that the cleanup of the Ross Metals Superfund Site protects human health and the environment."

A Proposed Plan Fact Sheet was released to the public which described EPA's preferred remedial alternative and invited public comments about the alternatives. The Administrative Record file was made available November 18, 1998. The file can be found at the information repository maintained at the EPA Docket Room in Region 4 and Rossville City Hall. The Notice of Availability of these two documents was published in the *Commercial Appeal* on November 18, 1998. A public comment period was held from November 18, 1998 to December 18, 1998. An extension to the public comment period was requested. As a result, it was extended to January 19, 1998. In addition, a public meeting was held on November 30, 1998 to present the Proposed Plan to a broader community audiences than those that had already been involved at the Site. At this meeting, the Tennessee Department of Environment and Conservation answered questions about problems at the Site and the remedial alternatives. EPA also used this meeting to solicit a wider cross-section of community input on the reasonably anticipated future land use. Public comments were received during this period. A transcript of the public meeting is included in the Responsiveness Summary, which is part of this ROD.

This decision document presents the selected remedial action for the Ross Metals OU#1 in Fayette County Tennessee. The remedial action chosen, is in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. The decision for this Site is based on the Administrative Record.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

As with many Superfund sites, the problems at the Ross Metals OU #1 are complex. As a result, EPA organized the work into two operable units (OUs). These are:

- OU #1: Contamination in the source materials.
- OU #2: Contamination in the aquifer.

The scope of this response action is to cleanup contaminated soil, wetlands, buildings and waste. Incidental ingestion of soil and the physical hazards pose the major risks to human health. Sediment poses an acute risk to ecological receptors. The cleanup of the source materials is proposed to prevent exposure to contaminated source materials and prevent contamination of groundwater and surface water. This response action is the first of two operable units that will be used to address the contamination of the entire Site.

Operable Unit #1 will address:

- Waste Slag (landfilled and stockpiled)
- Contaminated soil (in facility area and landfill area)
- Buildings
- Demolition debris (pavement)
- Contaminated sediment (in wetlands)

EPA generally expects to use treatment to address principal threats posed by a site, wherever practicable. Principal threat wastes are those source materials considered highly toxic or mobile that cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. For the Ross Metals Site, principal threat wastes conservatively include approximately:

- 600 cubic yards of soil
- 8,200 cubic yards of sediment
- 6,000 cubic yards of stockpiled slag
- 10,000 cubic yards of landfilled slag

Operable Unit #2 will require additional Site characterization studies in order to determine the nature and extent of potential groundwater contamination. A Feasibility Study may be required to identify and evaluate possible groundwater remedial actions.

2.5 SITE CHARACTERISTICS

2.5.1 Land Use

The area surrounding the Site is primarily rural or residential. A municipal wastewater treatment plant is located adjacent to the western Site boundary, and no other known industries would have contributed contamination to the Site. The towns of Rossville, Rossville Junction, and New Bethel are located within a 4-mile radius of the Site; the total population within the 4-mile radius is 1,947. The nearest school is located 0.3 miles southeast of the Site.

Current and reasonably anticipated future land uses and current and potential beneficial ground-water uses are discussed in Sections 2.6.1.2 and 2.6.1.5.

2.5.2 Climatology

The RM Site is located in southwest Tennessee, about 30 miles west of Memphis. This area has an average annual daily temperature of about 62.3 ^{o} F. The normal daily minimum and maximum temperatures are 52.4 ^{o}F and 72.1 ^{o}F, respectively. Annual precipitation is 52.10 inches. (Source: National Weather Service Historic Data for Memphis, 1961-1990).

2.5.3 Physiography

The RM Site is located in the Gulf Coast Plain Physiographic Province of western Tennessee, which is characterized by unconsolidated near-surface sands, silts, and clays. Elevations within the surrounding area vary from 290 to 470 feet National Geodetic Vertical Datum (NGVD) (USGS 1965). Ground elevations within the Site boundaries range from about 315 NGVD near the main office building to about 310 NGVD at the northeast corner of the fenced portion of the Site. The RM

Site is located about 0.5 miles south of the Wolf River.

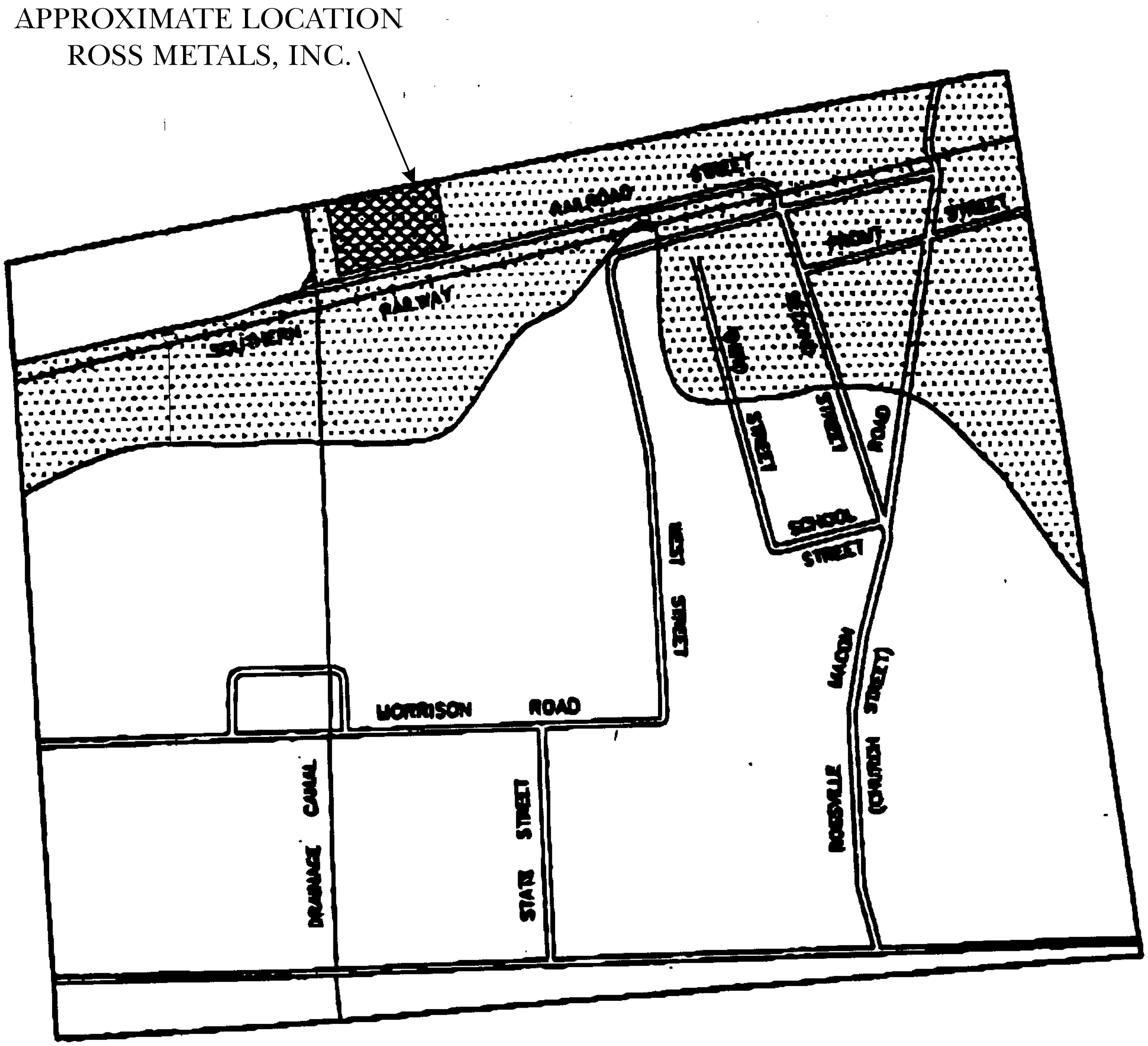
The RM Site consists of an old fenced facility area enclosing about 5.5 acres and a blast slag landfill covering about 2.5 acres north of the old fenced area, and contaminated wetlands located north and east of the facility and landfill areas, approximately 8.58 acres. The fenced area includes several buildings, most of which are constructed of sheet metal. Most of the area inside the fenced facility area is paved with either concrete or asphalt, and an asphalt curb is located just inside the fence. The curb was apparently constructed to divert storm water runoff to the storm water collection sump in the northeast corner of the property. Several stockpiles of waste slag are located in various buildings, including the wrecker building, the slag fixation container, the furnace raw materials refinery building, and the shipment building. The buildings are generally in poor condition, and some are in danger of collapsing.

The landfill area was constructed in a wetland area north of the fenced area. Several soil-covered mounds ranging up to 6 feet high are located in the landfill area. An 8-inch-thick concrete slab is located just north of the gate in the landfill area; however, evidence suggests that some slag may be buried beneath the concrete slab. An estimated 10,000 CY of slag is buried throughout the landfill at thicknesses of up to about 4 feet. About 1 to 2 feet of fill material has been placed over the slag throughout the landfill.

As indicated on **Figure 2-3**, the RM facility and the wetlands north and east of the facility are located in a 100-year floodplain. **Figure 2-4** illustrates the type of wetlands that are part of the RM Site.

2.5.4 Surface Water

Storm water runoff from the entire facility drains into a basin located at the northeastern corner of the fenced facility. The basin discharged to a small wetland area located north and northeast of the

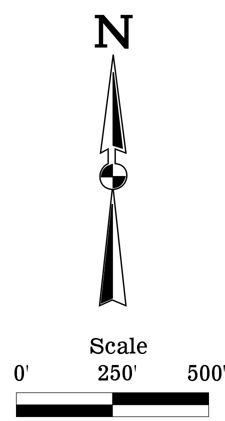


Legend:

100 Year Flood

NOTES:

1. Flooding effects from Wolf River
2. Flood information taken from Flood Insurance Rate Map for the town of Rossville, Fayette County, Tennessee.



Ross Metals Site Rossville, TN	100 Year Flood Plain Map	Figure No.: 2-3
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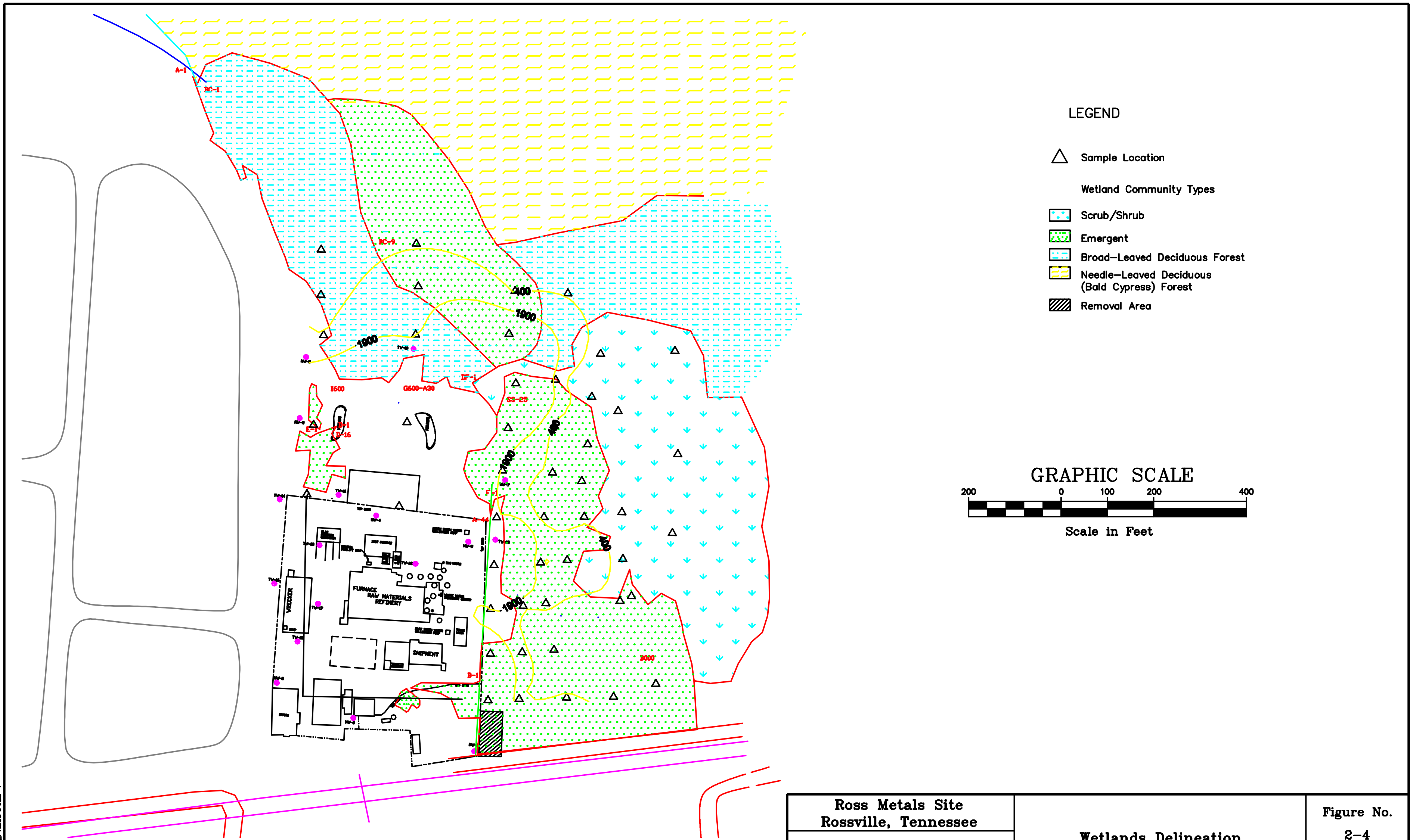


Ross Metals Site Rossville, Tennessee CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Wetlands Delineation	Figure No. 2-4 8/98

facility area. During an inspection on October 14, 1993, the holding dike of the storm water basin was observed to be overflowing, and storm water was apparently not being collected in on-Site storage tanks for wastewater treatment. Runoff from the landfill also drained to the wetland located north and northeast of the landfill; in addition, the landfill has no documented run-on, run-off, or collection facilities. The landfill is documented to lie adjacent to a wetland area; however, the wetlands are not delineated on the National Wetland Inventory (NWI) map.

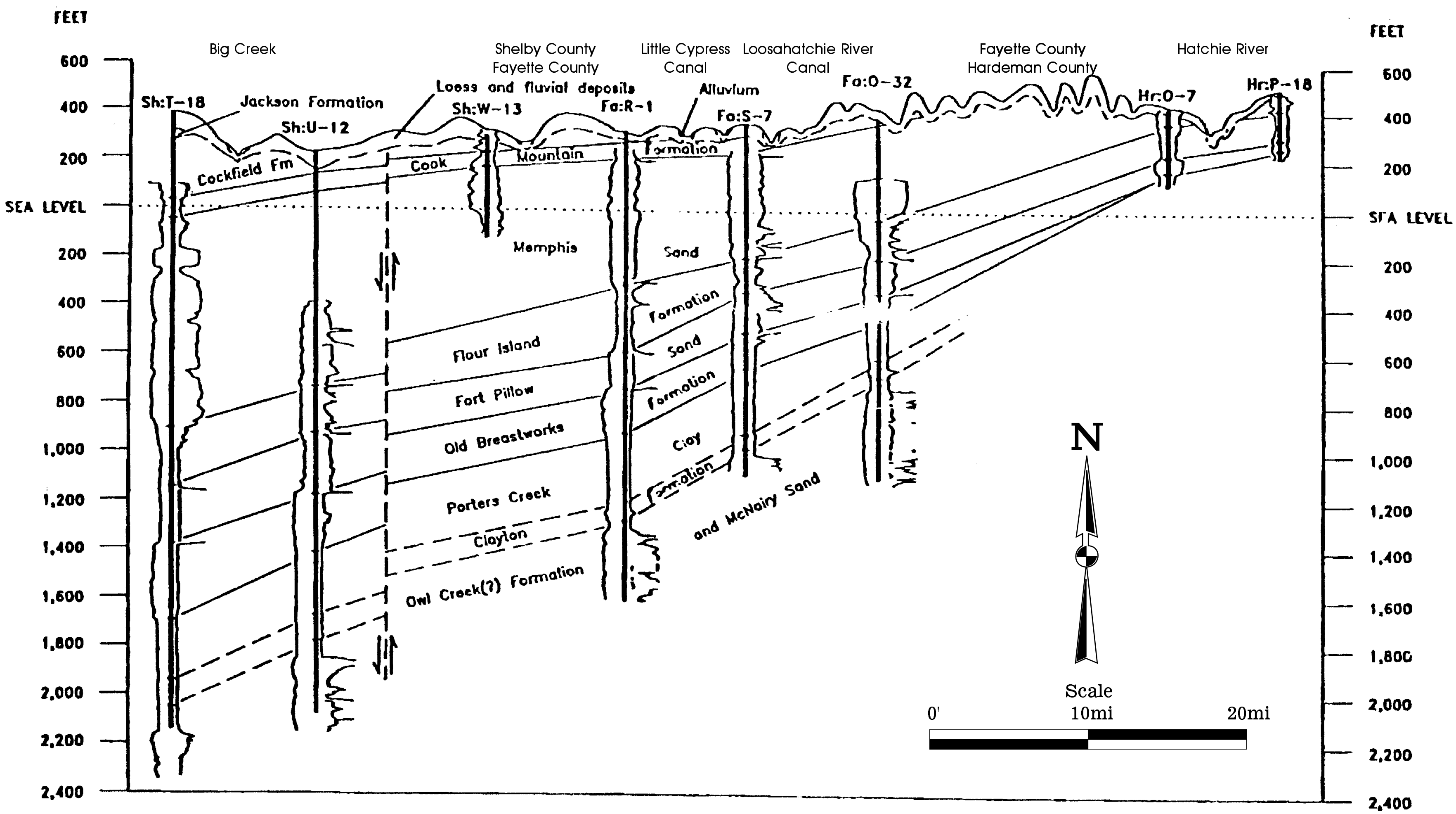
The wetlands and wooded area extend to the north and ultimately drain to the Wolf River, which is the main drainage body for the region. The Wolf River flows west, through Memphis, and into the Mississippi River.

The Rossville municipal wastewater treatment plant is located west of the RM Site. The outfall for the treatment plant is located on the Wolf River at the Highway 194 bridge, about 1.5 miles upstream of the facility. The outfall and the treatment plant are not expected to have any adverse effect on the wetland located north and northeast of the Site.

2.5.5 Geology and Hydrogeology

The Site is located in the Gulf Coast Plain Physiographic Province of Western Tennessee, which is characterized by unconsolidated near-surface sands, silts, and clays. Included in this sequence of unconsolidated sediments is the Memphis Sand, which contains an important water-bearing zone known as the Memphis aquifer. The Memphis Sand consists of a thick body of sand that contains clay and silt lenses or beds at various horizons. The sand ranges from very fine to very coarse (B&V 1996). A regional cross-section is provided as **Figure 2-5**.

Recharge of the Memphis aquifer generally occurs along the outcrop of the Memphis Sand. Recharge results from precipitation and from downward infiltration of water from the overlying fluvial deposits



Ross Metals Site
Rossville, Tennessee

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Regional Cross-Section

Figure No.
2-5

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and alluvium, where present. In the outcrop-recharge belt, the Memphis aquifer is under water-table conditions (unconfined), and the configuration of the potentiometric surface is complex and generally conforms to the topography. West of the outcrop-recharge belt, the aquifer is confined by other members of the Claiborne Group containing clay, silt, sand, and lignite. Groundwater in the unconfined portion of the Memphis aquifer typically flows to the west. Transmissivities of the Memphis aquifer in the Memphis area range from about 20,000 to 42,800 square feet per day. However, USGS literature referenced only one test conducted in Fayette County (the location of the RM facility); the test indicated a transmissivity of 2,700 square feet per day. (B&V 1996).

The RM facility was constructed in part of a wetland; RM reportedly spread and compacted several feet of clay prior to constructing the facility. A 1987 memorandum written by the State of Tennessee indicates that clayey silt was present in the area of the industrial landfill before its construction; the clayey silt was present from 0 to 3 feet, and a silty clay was present from about 3 to 7 feet.

In May 1988, five monitoring wells were installed by RM's contractor. The borings for the monitoring wells indicated the presence of about 11 feet of silty clay and clayey silt overlying sands of the Memphis Sand aquifer. In May 1997, eight additional monitoring wells were installed at the Site. A soil boring (T-4) was also drilled in the southwest corner of the Site, but it was not completed as a monitoring well. Monitoring well depths ranged from 23 to 28 feet below ground surface (bgs).

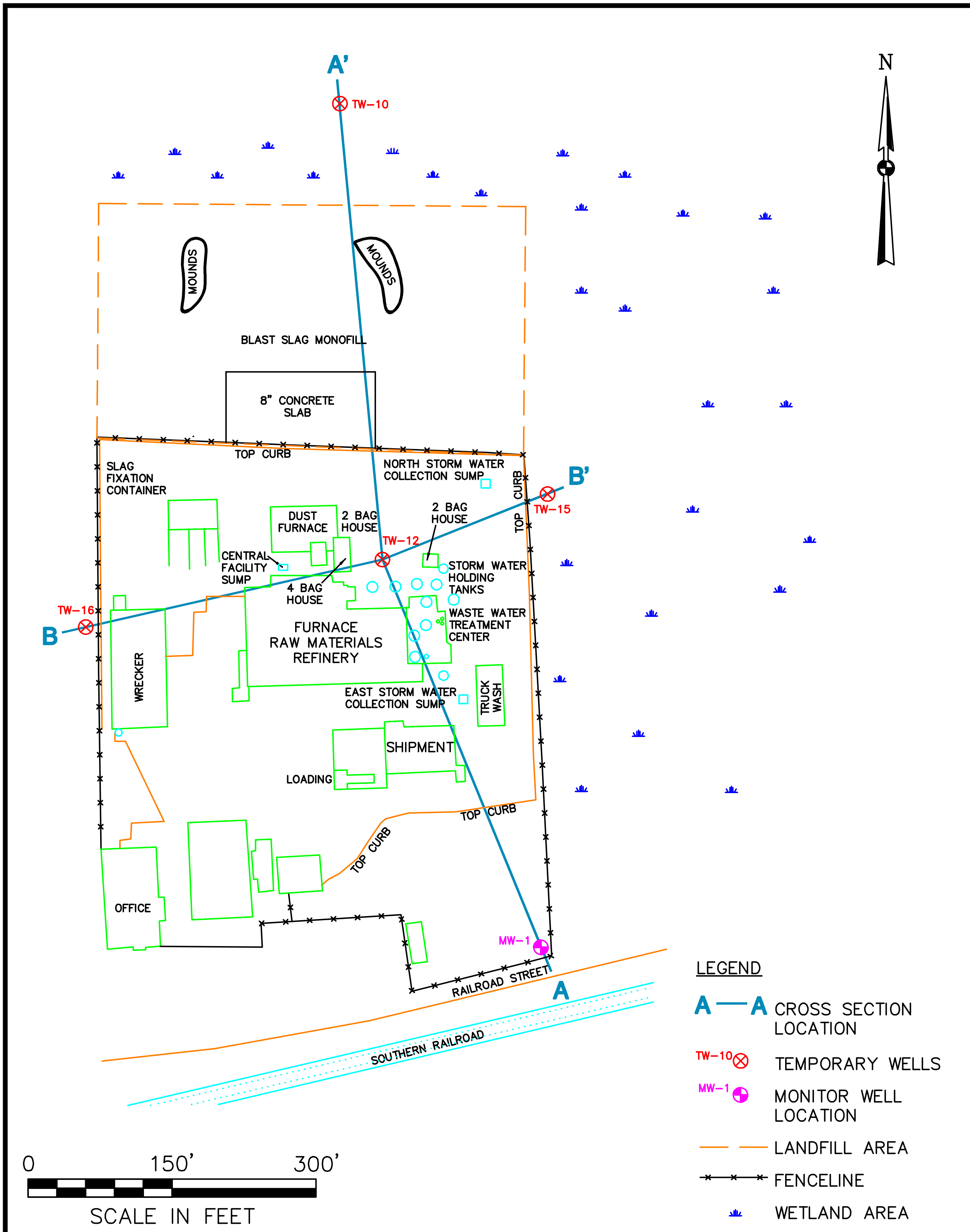
Soil samples collected during soil boring activities revealed that Site stratigraphy conformed generally to the May 1988 data collected by the RM contractor. The predominant soil type observed in surficial to shallow soil intervals (within 10 feet bgs) consists of gray, mottled, dry to moist clay. The clay unit contains a high percentage of silt (except in the western portion of the Site, where it grades to sandy clay); exhibits low plasticity and variable organic content; and occasionally exhibits a brown to tan coloration. The clay unit extends from ground surface to depths ranging from 7 to 20 feet bgs and is generally thickest in the western portion of the Site.

Sands encountered at the Site are fine-grained and grayish-white in color. Sands are generally well sorted and exhibit a fine to medium texture with occasional clay lenses and very little silt. Sand textures generally coarsen with increasing depth, becoming medium to coarse in texture below 20 feet bgs. A trend toward a decrease in the degree of sorting and an increase in the coarse sand fraction was also observed in samples collected from below 20 feet bgs.

Groundwater at the Site is encountered in the upper portion of the sand section. The aquifer possesses a degree of hydrologic confinement due to the pervasive upper clay section, and water levels in Site monitoring wells rise above the base of the clay unit.

Information collected during the 1988 and 1997 investigations conducted by the RM contractor and PRC, respectively, conflict somewhat with a Tennessee memorandum written in 1987 concerning the actual depth of clay beneath the Site. However, it can be assumed that at least 7 feet of silty clay and clayey silt are present directly under the Site; it remains undetermined how much, if any, of it is native material. Some of the clay may be part of the base of the Cook Mountain Formation or a clay lens within the upper part of the Memphis Sand. Occurrences of the overlying members of the Claiborne Group in the area of the Site may be thin or absent above the Memphis Sand. **Figures 2-6** and **2-7** present cross-section information obtained from the EPA Site investigations. Additional cross-sections were prepared for this RI/FS report using boring logs from monitor wells constructed in 1997. The 1997 boring cross-section locations are illustrated on **Figure 2-8**. The 1997 cross-sections are presented on **Figures 2-9** and **2-10**.

Although regional groundwater flows to the west, measurements collected from Site monitoring wells in 1990 indicate that shallow groundwater movement is north towards the Wolf River. However, measurements collected from the monitoring wells in 1996 suggest a more northwesterly movement of groundwater. **Figures 2-11** and **2-12** present groundwater flow based on measurements collected in an October 1990 investigation, and November 1996 investigation, respectively. Two municipal



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Ross Metals Site Rossville, Tennessee	Cross-Section Locations	Figure No. 2-6
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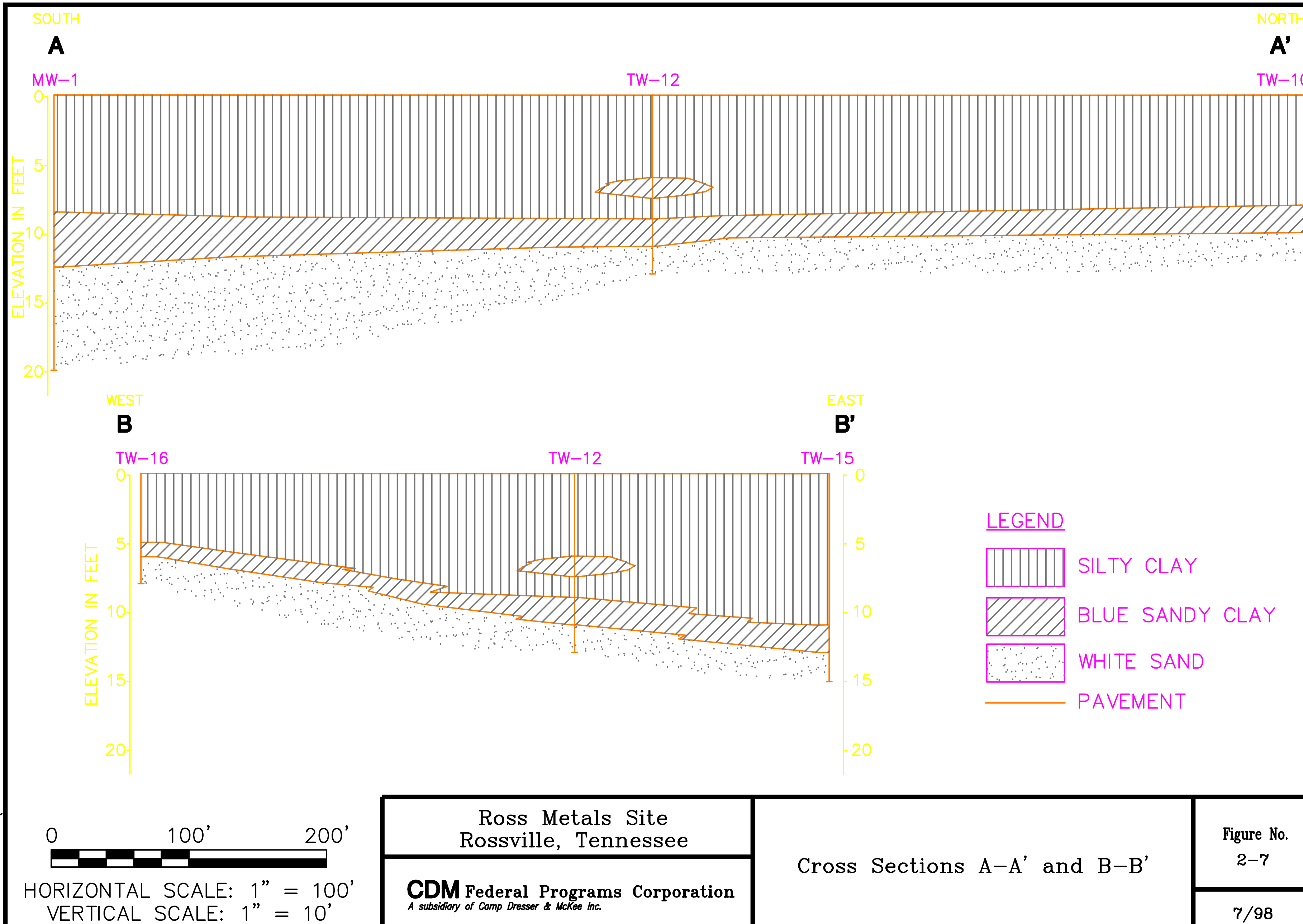
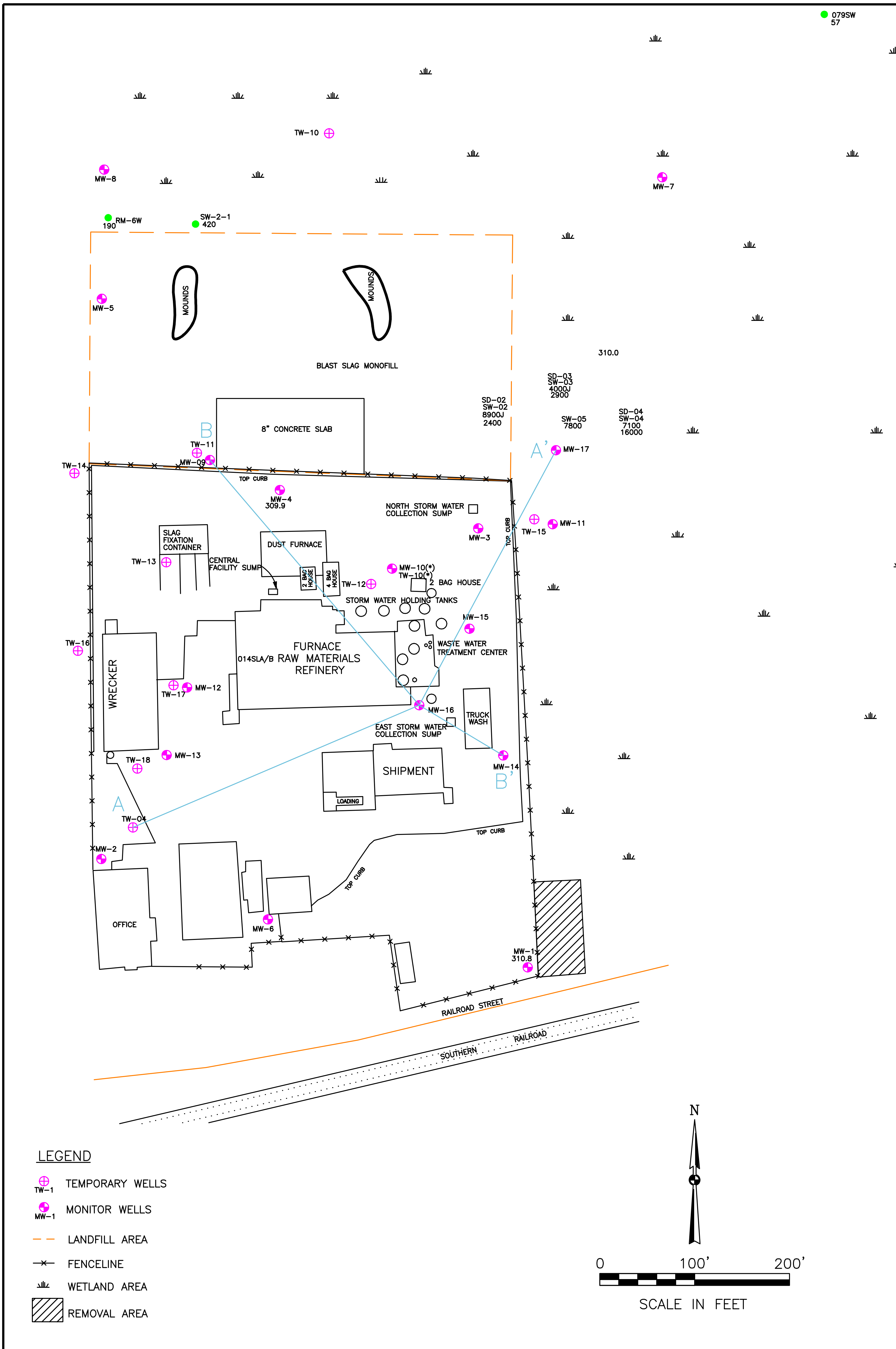


ACAD FILE: ROSS\CS–AA

Ross Metals Site Rossville, Tennessee **CDM** Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*	Cross Sections A–A' and B–B'	Figure No. 2–7 7/98



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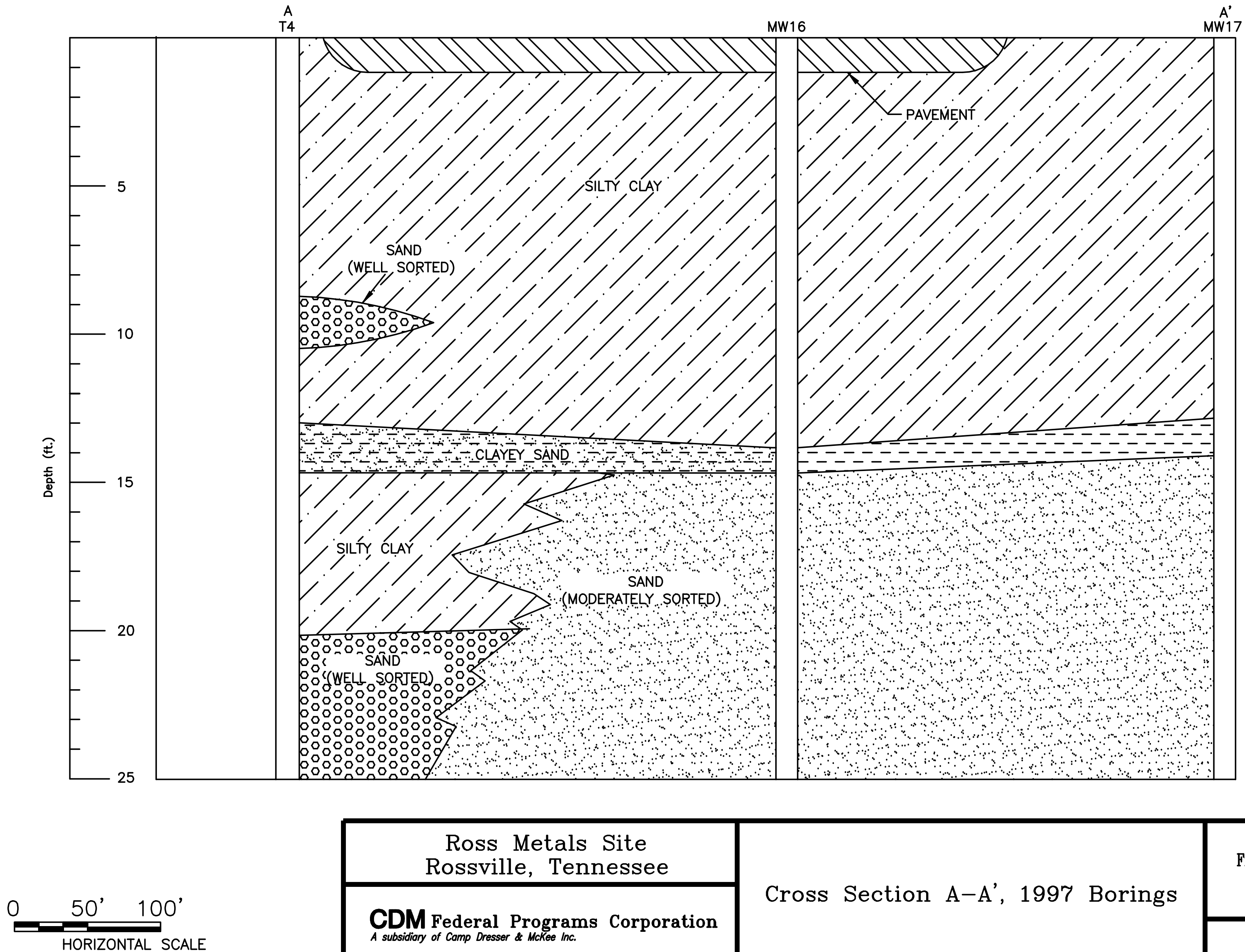
Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

Cross Section Locations-1997 Borings

Figure No.
2-8

8/98



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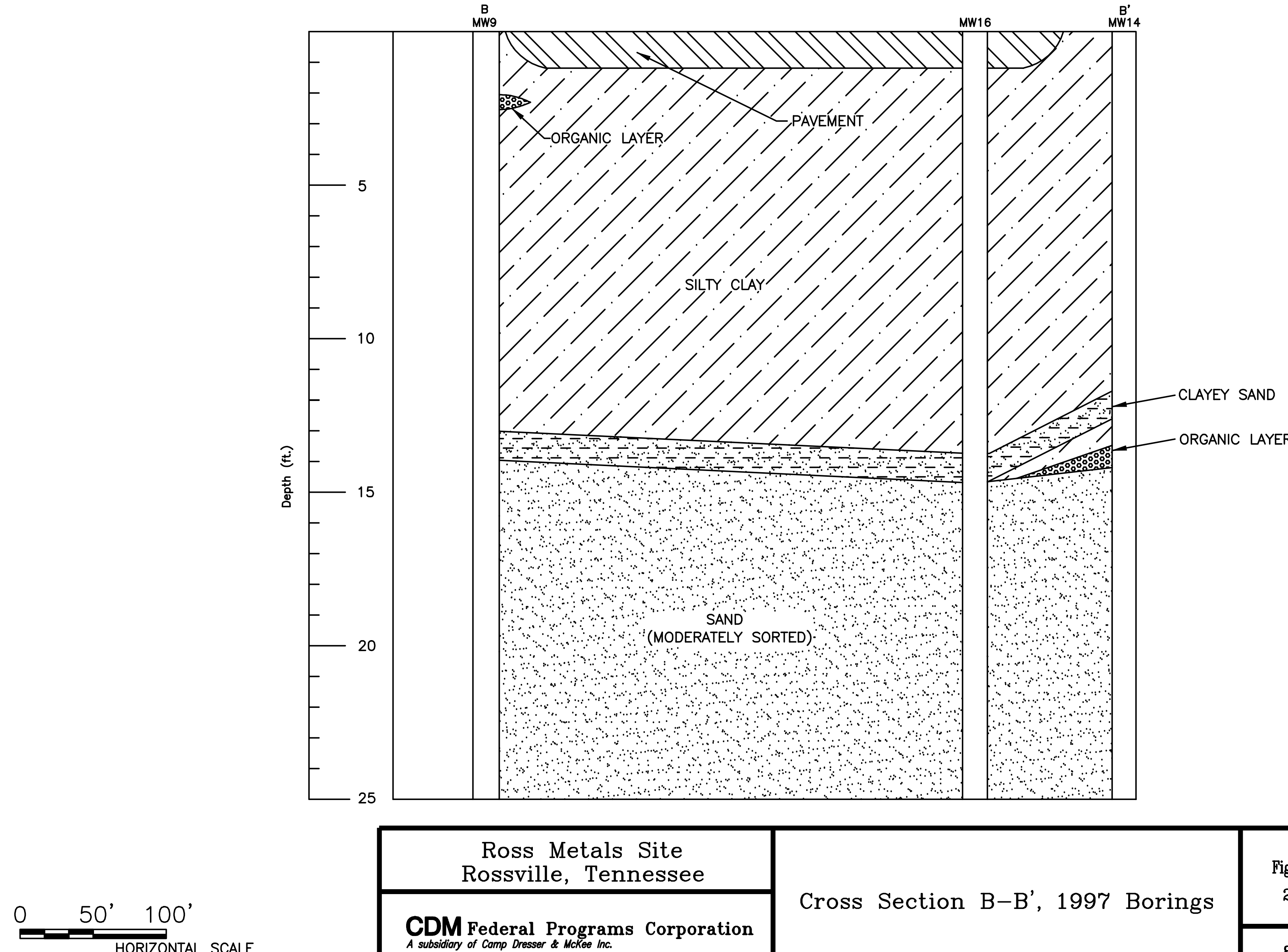
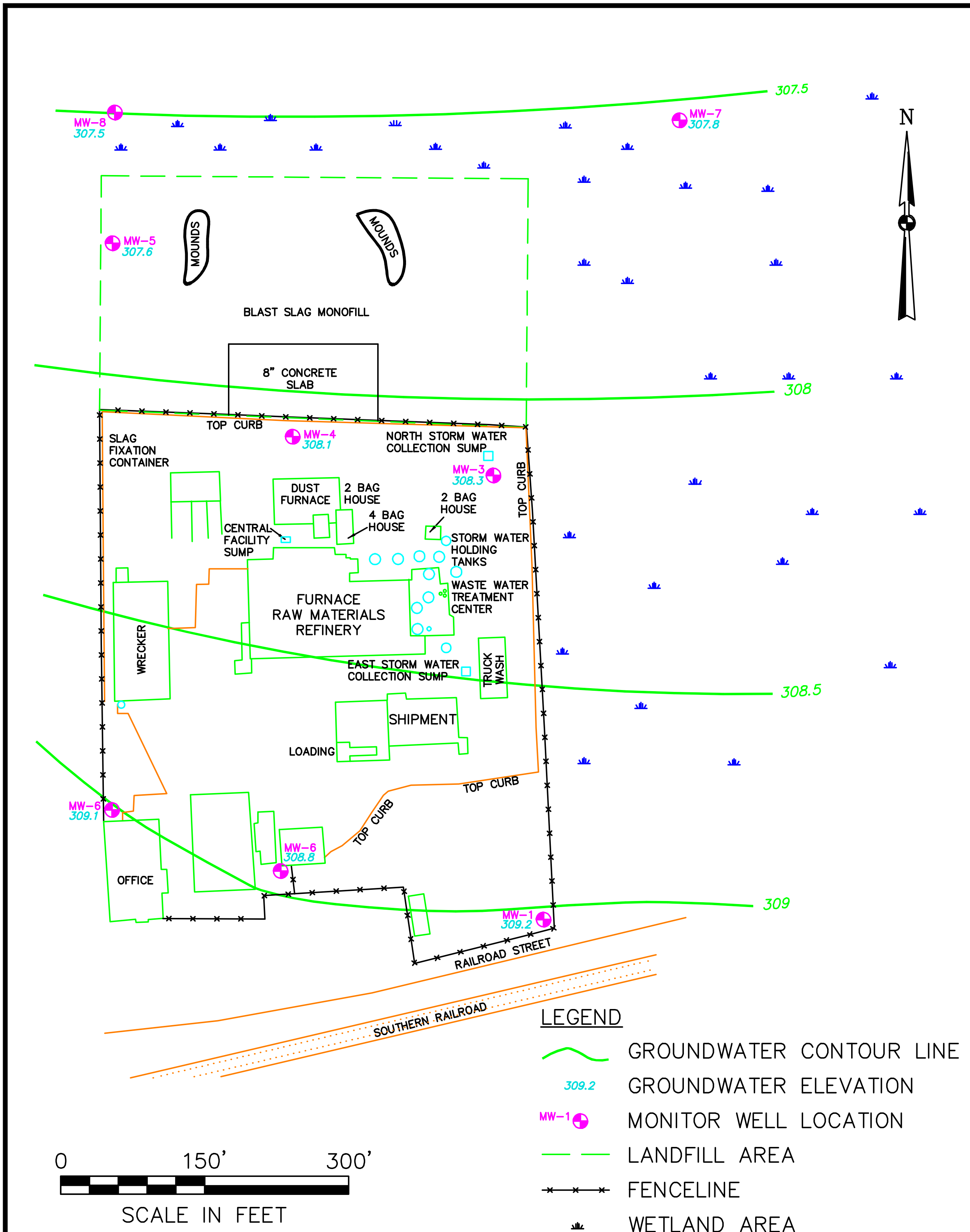
Ross Metals Site Rossville, Tennessee	Cross Section A–A', 1997 Borings	Figure No. 2–9
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		8/98



ACAD FILE: crosB

Ross Metals Site Rossville, Tennessee	Cross Section B–B', 1997 Borings	Figure No. 2–10
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		8/98



ACAD FILE: ROSS\ROSS-GW

Ross Metals Site Rossville, Tennessee	Potentiometric Surface Map October 1, 1990	Figure No. 2-11
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		7/98

Figure 2-12 Potentiometric Surface Map - November 1996 supply wells and three industrial production wells are located within 0.75 mile of the Site and are screened in the Memphis aquifer.

2.5.6 Previous Investigations

EPA has conducted numerous sampling investigations at the RM Site. A discussion of sample results from these investigations is presented in Section 2.5.7.

In May and November 1990, EPA Region 4 conducted RCRA investigations that included the collection of groundwater, surface water, surface soil, and slag samples.

From September 22 through December 29, 1994, the EPA Emergency Response and Removal Branch (ERRB) conducted an emergency time-critical removal of hazardous substances at the RM Site. Source materials, structures, and debris were removed and disposed of off Site. Approximately 4,400 gallons, 170 tons, and 1,700 CY of waste were removed. Groundwater and surface soil samples were also collected during this event.

During the week of June 13, 1995, EPA conducted a Site Investigation for Hazard Ranking System purposes. Groundwater, surface and subsurface soil, sediment, and surface water samples were collected.

In November 1996, EPA conducted site characterization studies that included surface and subsurface soil, groundwater, surface water, and wipe samples from the buildings.

During the weeks of May 19 and May 26, 1997, EPA conducted additional field sampling at the Site. EPA completed the installation and sampling of nine monitoring wells, including borehole soil sampling. Two additional groundwater samples were collected from on-Site temporary wells, and one groundwater sample was collected from a well at the wastewater treatment plant on adjacent property located west of the RM Site. Soil samples from the landfill and a composite sample of slag stockpiles were also collected for analysis.

The presence of lead-based paint in homes near the Site has been documented. File material indicates that children living near the Site have had elevated levels of lead in their blood. The children were moved by Housing and Urban Development. Although the documentation is not strong enough to establish an observed release, the findings are significant because of the proximity of adjacent residences and the history of the RM Site. Soil samples collected adjacent to nearby homes indicated 1,170 parts per million (ppm) of lead. An EPA time-critical removal (1994) of soils was performed at this residence.

In April 1997, EPA collected surface water, sediment, plant tissue, grasshopper, and frog tissue samples as part of the completion of an ecological risk assessment for the Site. All the sediment samples were analyzed for arsenic, cadmium, copper, and lead via field portable x-ray fluorescence (XRF). In addition, several of the surface water and sediment samples collected for the ecological risk assessment were analyzed for TAL metals by an offsite laboratory. Samples from two of the surface water and sediment locations analyzed for TAL metals also were analyzed for volatile organic compounds (VOCs), base neutral acids (BNAs) and pesticide/PCBs. Surface water and sediment results are discussed in Section 2.5.7.1 and 2.5.7.3.

In December 1997, EPA/ERTC collected and performed on-Site analysis of soil samples for metals contamination, to delineate contaminant levels in the wetlands. Additionally, the effort involved the completion of treatability studies to evaluate soil treatment, and the completion of a wetlands excavation and revegetation plan to provide a design for wetlands restoration. Target elements were arsenic, cadmium, lead, and zinc. A reference grid was established on the Site and surface samples were collected at the grid nodes. The grid included the wetlands located north and east of the Site.

The results of 29% of the samples were confirmed by Inductively Coupled Plasma (ICP) analysis.

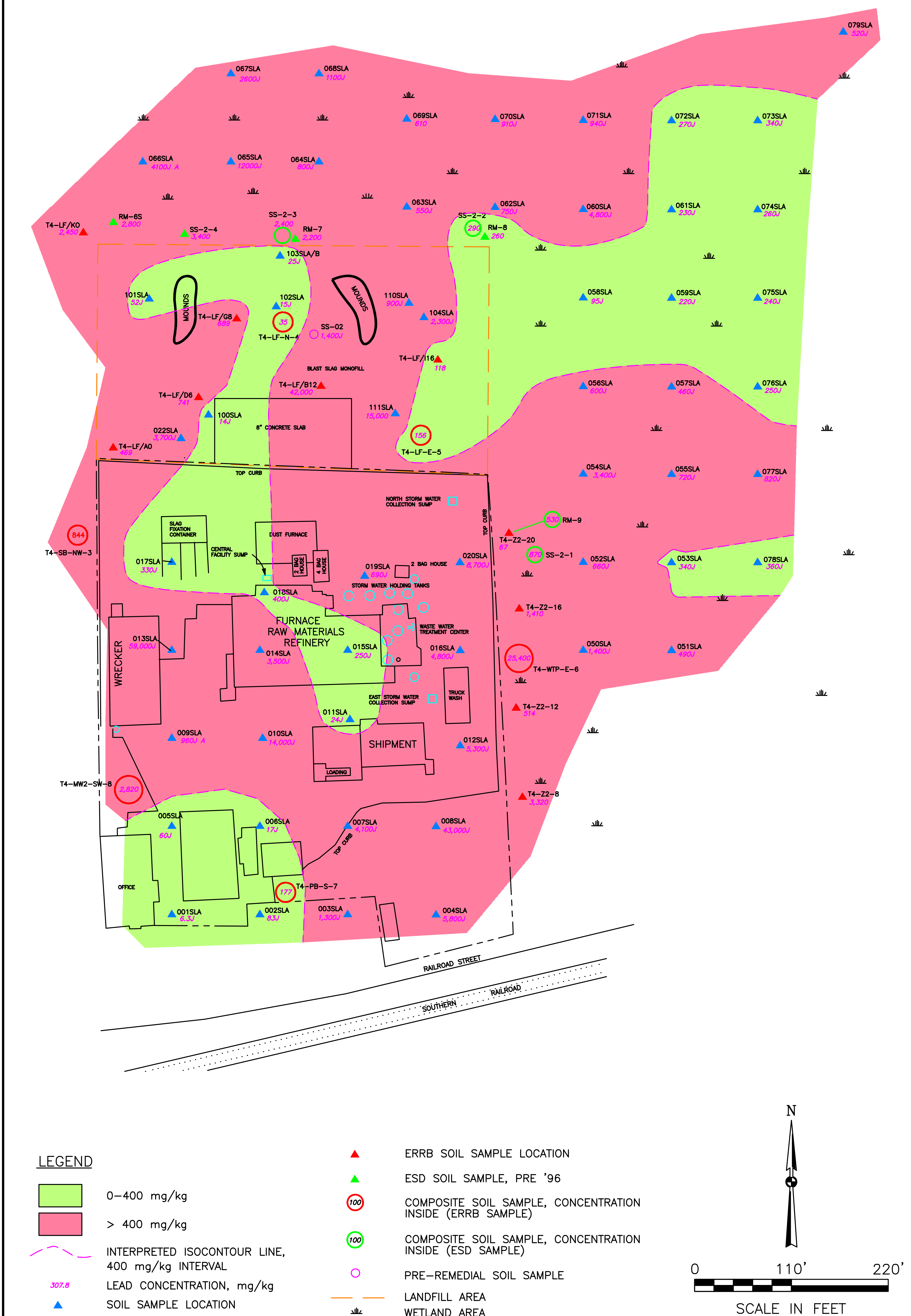
In June and September 1998, EPA conducted a second time-critical removal. The removal action included fencing the soils which contained lead above 400 ppm; covering the waste piles with tarpaulins; and posting the Site as a Superfund Site.

2.5.7 Nature and Extent of Contamination

2.5.7.1 Soil and Sediment

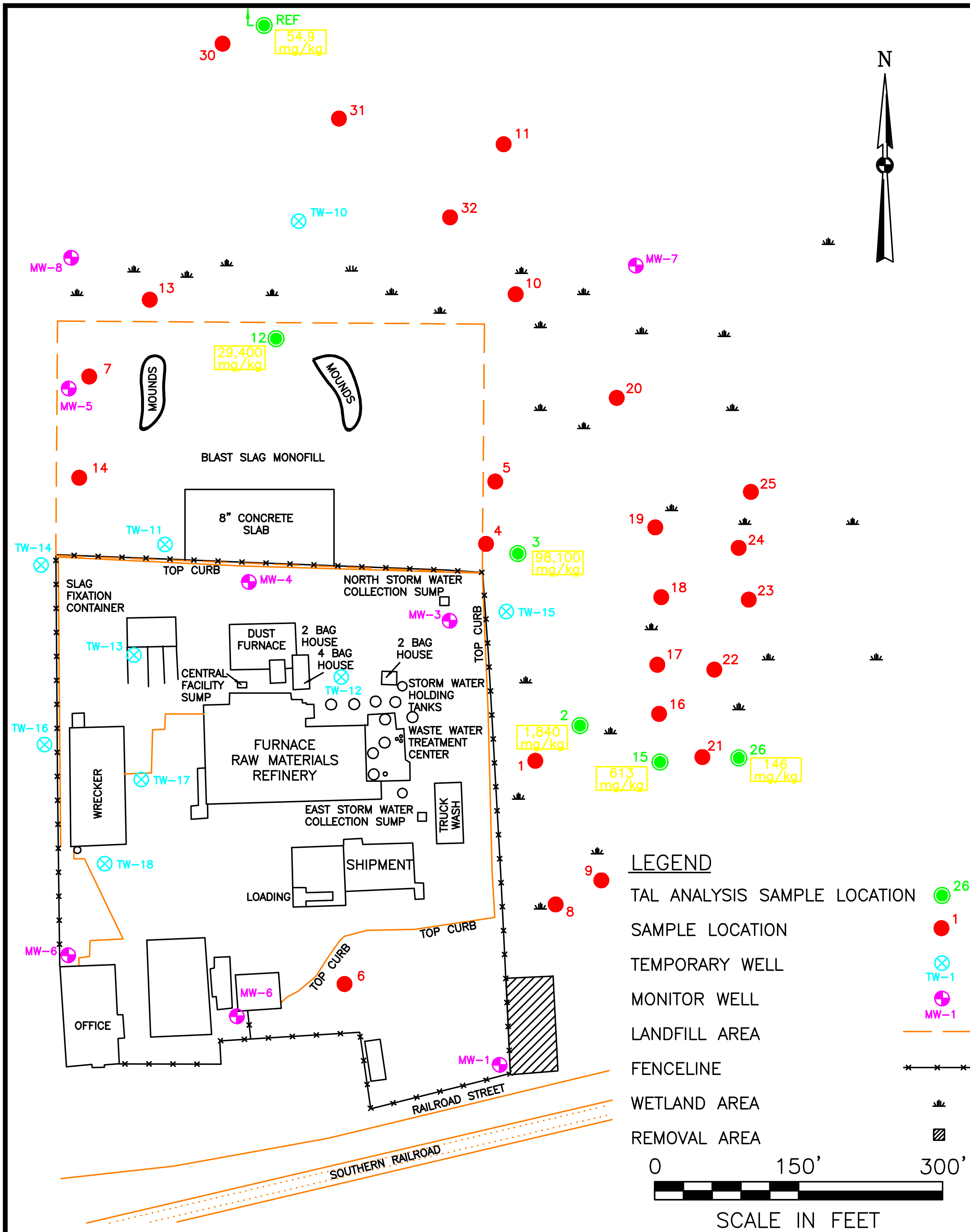
Surface soil and sediment samples were collected at depths of up to 2 feet bgs. Lead-contaminated surface soil is present across the Site and in the wetlands north and east of the facility. Lead concentrations in most surface soil and sediment samples collected throughout the Site exceeded 400 ppm. In addition, aluminum, antimony, arsenic, barium, cadmium, copper, iron, manganese, selenium, and vanadium were detected above risk-based remedial goal option (RGO) levels. **Figure 2-13 and 2-14** illustrate the extent of surface soil lead contamination throughout the Site. Additional samples collected as part of an ecological risk assessment and analyzed using both XRF analysis and ICP procedures showed a widespread presence of lead and other COCs defined in the risk assessment above RGO levels in the wetlands north and east of the Site. **Figure 2-15** illustrates lead concentration contours in the wetlands based on XRF and TAL samples collected in December 1997.

The highest levels of subsurface soil contamination were found in two isolated locations at the Site; east of the wrecker building, and southeast of the truck wash. **Figure 2-16** illustrates the extent of subsurface soil lead contamination at the Site. Elevated lead concentrations were collected at depths ranging from 18 to 40 inches beneath the pavement near the wrecker building and the truck wash and at depths of up to 5.5 feet in the landfill; however, as Figure 2-16 indicates, none of the soil samples collected from beneath the buried slag exhibited lead concentrations in excess of the RGO level.



Ross Metals Site Rossville, Tennessee	Extent of Lead in Surface Soils	Figure No. 2-13
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		8/98

ACAD FILE: ROSS\ROSS-ISO



Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

Maximum Lead Results in Sediment
(TAL Analysis –
Ecological Investigation)

Figure No.
2-14

7/98

ACAD FILE: ROSS\LEADSED

LEGEND

Sample Location

Wetland Community Types

Scrub/Shrub

Emergent

Broad–Leaved Deciduous Forest

Needle–Leaved Deciduous (Bald Cypress) Forest

800 Lead Concentration Contour (mg/kg)

GRAPHIC SCALE

200 0 100 200 400

Scale in Feet

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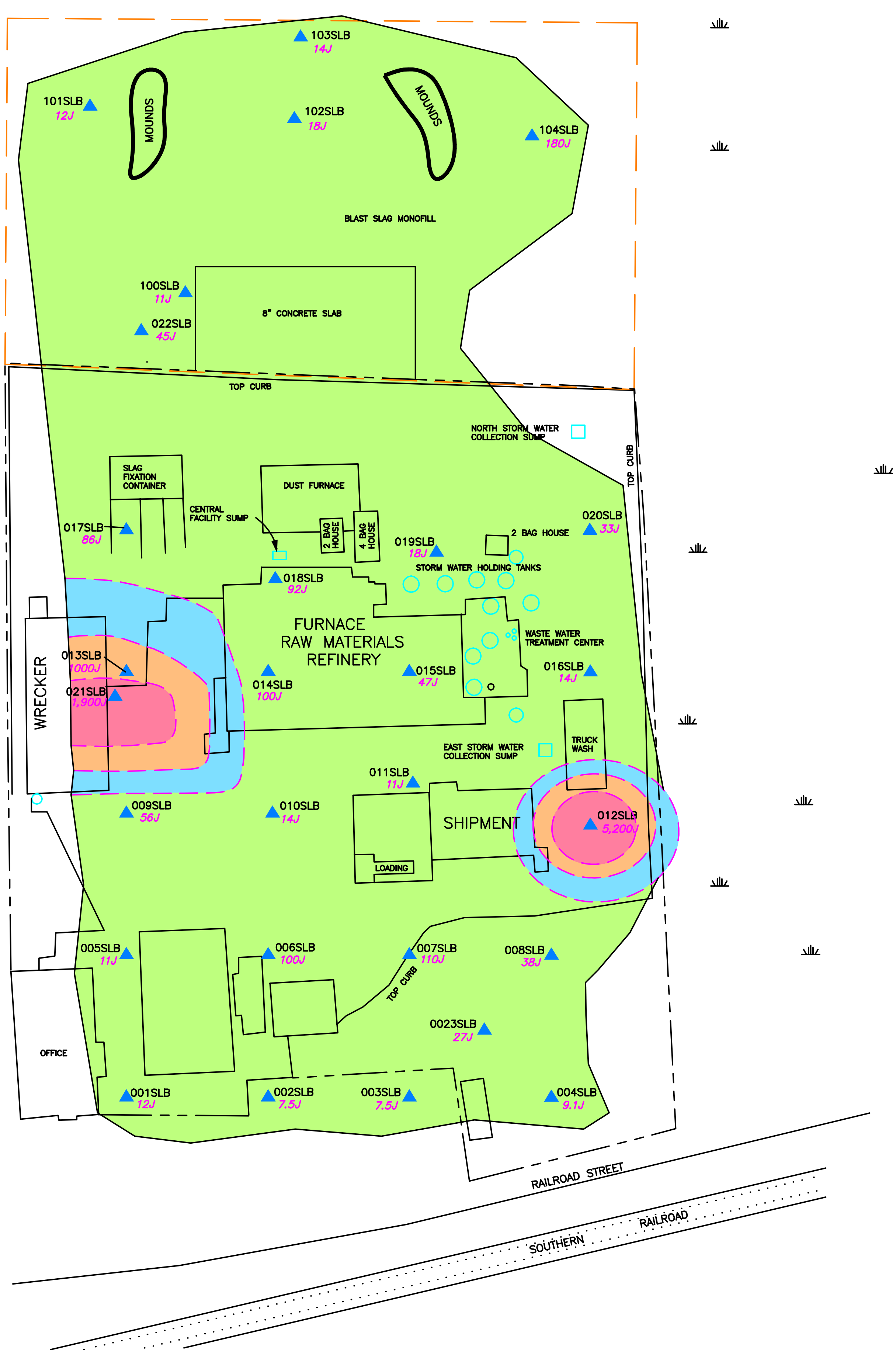
Ross Metals Site Rossville, Tennessee CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Contaminant Contour in Wetlands March 1998	Figure No. 2–15 8/98



LEGEND

0–400 mg/kg

401–800 mg/kg

801–1200 mg/kg

>1200 mg/kg

INTERPRETED ISOCONTOUR LINE, 400 mg/kg INTERVAL

307.8 LEAD CONCENTRATION, mg/kg

SOIL SAMPLE LOCATION

LANDFILL AREA

WETLAND AREA

N

0 100' 200'

SCALE IN FEET

ACAD FILE: ROSS\ROSS-IS02

Ross Metals Site Rossville, Tennessee CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Extent of Lead in Subsurface Soils	Figure No. 2-16 8/98

In addition to soils, other solid media were sampled during previous investigations. Waste slag samples contained total lead concentrations ranging from 18,500 to 94,800 milligrams per kilogram (mg/kg). Total lead and TCLP lead concentrations in a floor wipe sample collected from the furnace and raw materials refinery building were 14,700 mg/kg and 574 mg/L, respectively.

2.5.7.2 Groundwater

Analytical results of groundwater samples revealed the presence of several inorganic compounds at concentrations that either exceed the primary or secondary drinking water standards or the State of Tennessee domestic water supply criteria. Aluminum, arsenic, barium, cadmium, chromium, iron, lead, manganese, nickel and vanadium were detected above respective guidance concentrations and/or RGO levels. Lead concentrations in filtered groundwater samples ranged from nondetectable to 770 micrograms per liter (*u*g/l); the EPA action level for lead in groundwater is 15 *u*g/L.

Using only the filtered data set from the May 1997 sampling event, it appears that groundwater lead contamination is limited to an area just east and downgradient of the RM wrecker building. Under this assumption, the horizontal extent of the contaminant plume is about 300 feet by 200 feet. In contrast, using groundwater quality data from all historic unfiltered samples, combined with unfiltered and filtered data from the May 1997 sampling event, it could be interpreted that groundwater contamination is Site-wide. In this case, the entire Site would be considered a source. Under this assumption, the horizontal extent of the contaminant plume is at least 800 feet by 450 feet and extends off Site.

Although EPA Region 4 policy is to use only unfiltered sample results for risk assessment and determining extent of contamination, the difficulty in using the historic unfiltered sample data and even the May 1997 unfiltered sample data is that the turbidity of these samples does not meet EPA Region 4 Standard Operating Procedure goal of less than 10 NTU. The results from the unfiltered samples with high turbidity are not representative of lead concentrations in fully developed water supply wells because water supply wells in regular use do not produce water with high turbidity due to the development of a natural filter pack around the well screen (EPA 1998d). In addition, the results for MW5 presented on **Figure 2-17** indicate that recent samples do not confirm earlier sample results. Reported lead concentrations declined from 500 ug/l to 3 ug/l in seven years. This decline is difficult to explain because lead is not degradable and the source has not been removed. The lower levels present in the more recent sampling events suggest that the earlier data may not be valid.

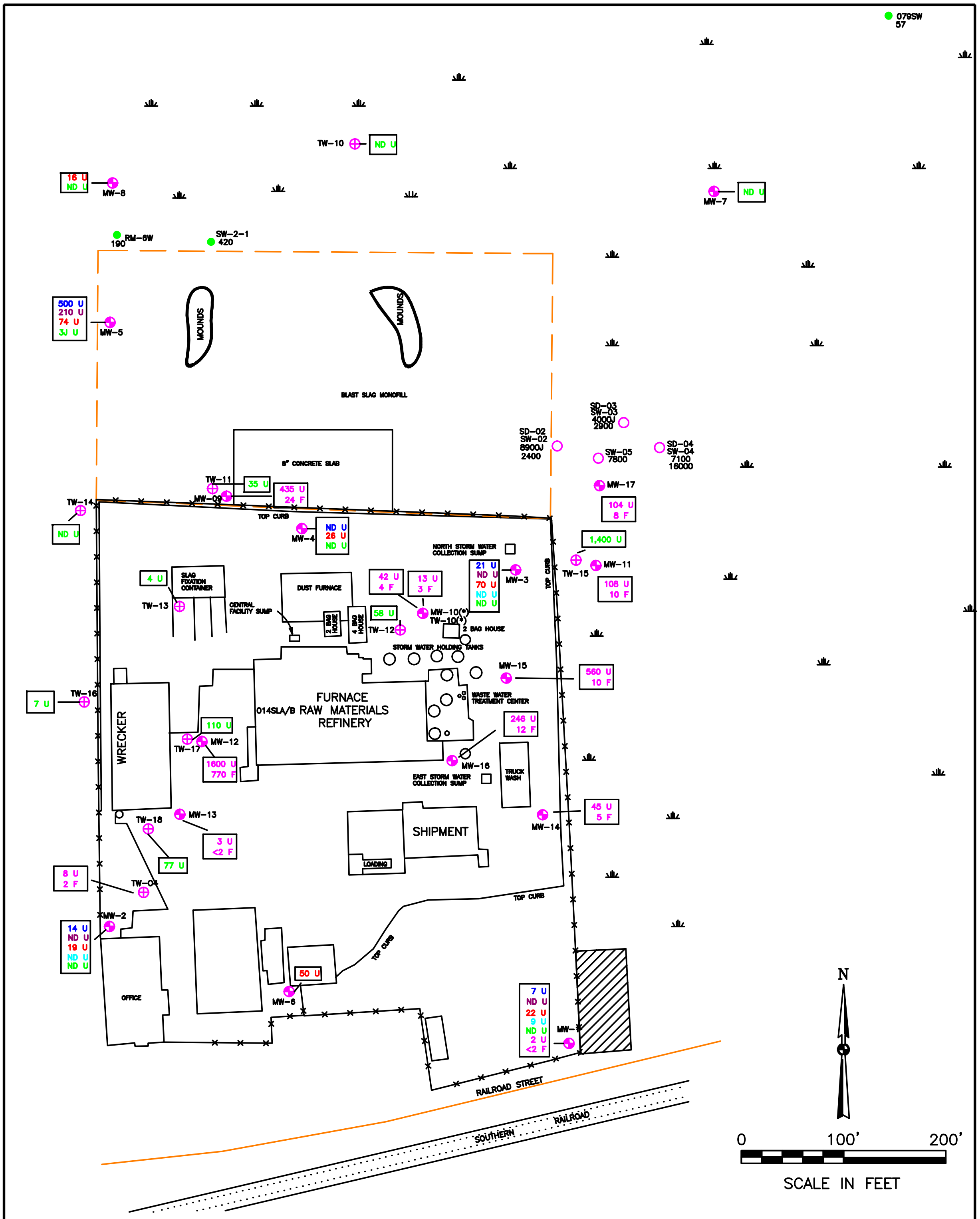
The high turbidity associated with the unfiltered samples collected at the RM Site means that the horizontal extent of contamination remains undefined. It may be much less than the current data indicate. Field measurements collected during the 1997 sampling event suggest that measurements with acceptably low turbidity could be attained at this Site with longer development periods.

In addition, the vertical extent of groundwater contamination has not been determined since there are no deep wells or cluster wells at the Site which could be used to determine the vertical hydraulic gradient. Without this information, vertical extent of contamination cannot be defined. It is important to have an understanding of the vertical extent of contamination to effectively evaluate potential remedial alternatives to use in the remediaiton of the contamination.

Based on the groundwater information, EPA has divided the Site into Operable Units with the source materials being the first Operable Unit and the groundwater being the second. Additional data will be necessary for defining the nature and extent of groundwater contamination.

2.5.7.3 Surface Water

Analytical results of surface water samples revealed concentrations of several inorganic compounds that exceeded background concentrations. Significant inorganic contaminants included antimony,



LEGEND

TW-1 TEMPORARY WELLS

MW-1 MONITOR WELLS

GROUND WATER DATA BOX, RESULTS ug/L

- X 40 X – ESD RESULTS (MAY 1990)
- X 27 X – ESD RESULTS (NOVEMBER 1990)
- X 15 X – ERRB RESULTS (OCTOBER 1994–JUNE 1995)
- X 35 X – PRE – REMEDIAL–HRS (JUNE 1995)
- X 20 X – REMEDIAL SITE CHARACTERIZATION (NOVEMEBER 1996)
- X 20 X – PRC (MAY 1997)

1 SURFACE WATER, ESD, ug/L Pb

PRE–REMEDIAL SURFACE WATER SAMPLE

REMOVAL AREA

LANDFILL AREA

FENCELINE

WETLAND AREA

NOTES

ESD	ENVIRONMENTAL SERVICES DIVISION
ERRB	EMERGENCY RESPONSE AND REMOVAL BRANCH
HRS	HAZARD RANKING SYSTEM
U	UNFILTERED
F	FILTERED
ug/L	MICROGRAMS PER LITER (UNITS FOR ALL WATER SAMPLES)

(*) NOTE – TW-10 AND MW-10 SAME BORING, SAMPLES TAKEN AT DIFFERENT DEPTHS.
TW – SHALLOW SAMPLE COLLECTED DURING BORING.
MW – WELL SAMPLE COLLECTED AFTER COMPLETION

ACAD FILE: ROSS\ROSSH20

Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
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Total Lead Concentrations – Water

Figure No.
2-17

7/98

arsenic, cadmium, iron, lead, and manganese. **Figure 2-17 and 2-18** illustrate lead concentrations in surface water.

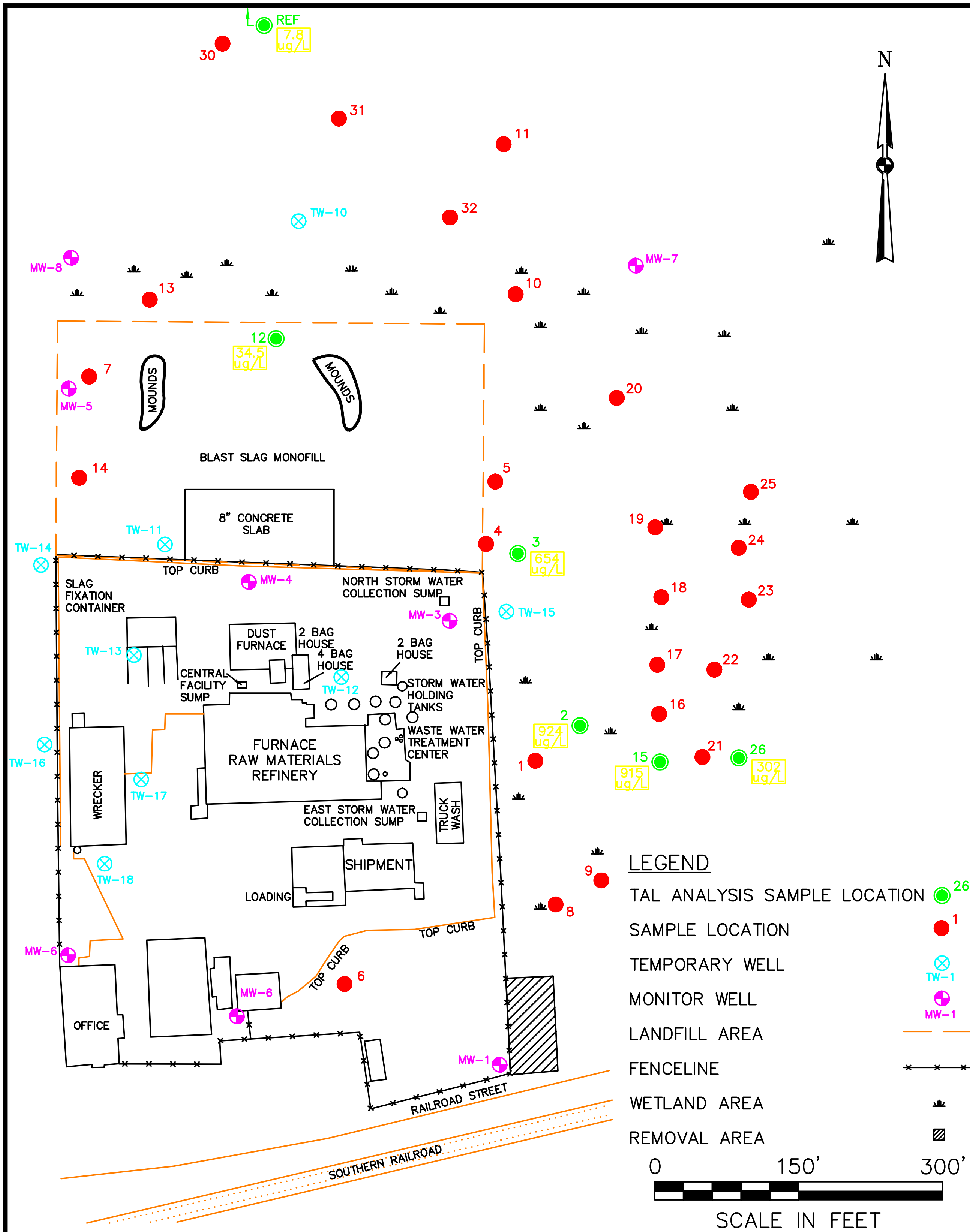
2.5.7.4 Contaminant Fate And Transport

Metals, notably lead, are the primary contaminants of concern (COC) associated with the Site; these contaminants are found in soils, structures, groundwater, and surface water. These contaminants are not typically highly mobile in the environment and move primarily by soil/sediment or wind transport.

Primary mechanisms available for contaminant transport away from the RM Site are rainwater runoff, rainwater infiltration to groundwater, and windblown dust movement. A conceptual site model is presented in **Figure 2-19**. The following transport mechanisms have affected contaminants at the RM Site:

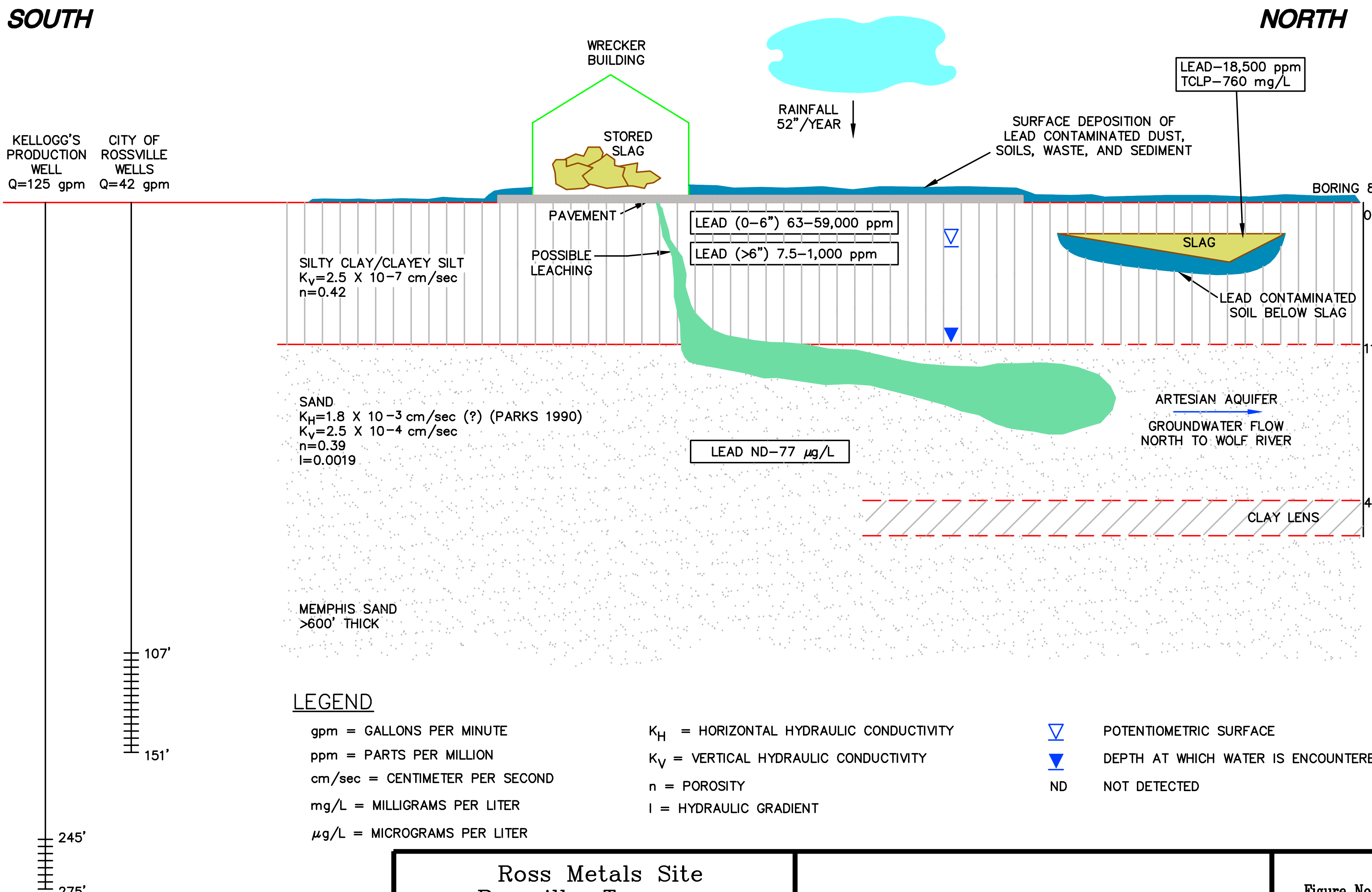
- **Rainwater Infiltration to Groundwater:** Rain falling directly on Site or as runon to the Site moves through contaminated soils and structures. This water picks up soluble contaminants, such as metals, and during periods of heavy rainfall, moves sediments containing contaminants. Most of the area is paved and a concrete curb, which was built some years after the facility began operation, extends around most of the old fenced area. However, much of the pavement is in poor condition, allowing water seepage at the pavement discontinuities and infiltration to groundwater. A storm water collection sump located in the northeast corner of the old fenced area, apparently overflows during rain events creating runoff flow at the northeast corner of the property. Runoff appears to continue to migrate east and northeast of the old fenced area, where it enters the groundwater by infiltration. Within the landfill area, water flowing through contaminated material (buried slag) infiltrates into groundwater.

- **Windblown Dust Movement:** The old fenced portion of the RM Site is essentially devoid of vegetative cover. During dry periods, high winds could transport contaminants away from the Site with windblown dust. When the facility was in operation, wind could have transported contaminants in air coming from the exhaust stack away from the Site.



ACAD FILE: ROSS\LEADSW

Ross Metals Site Rossville, Tennessee	Lead Results in Surface Water (TAL Analysis – Ecological Investigation)	Figure No. 2-18
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		6/98



LEGEND

gpm = GALLONS PER MINUTE
ppm = PARTS PER MILLION
cm/sec = CENTIMETER PER SECOND
mg/L = MILLIGRAMS PER LITER
µg/L = MICROGRAMS PER LITER

K_H = HORIZONTAL HYDRAULIC CONDUCTIVITY
K_V = VERTICAL HYDRAULIC CONDUCTIVITY
n = POROSITY
I = HYDRAULIC GRADIENT

▽ POTENTIOMETRIC SURFACE
▼ DEPTH AT WHICH WATER IS ENCOUNTERED
ND NOT DETECTED

ACAD FILE: ROSS\CONCEPT2

NOT TO SCALE

Ross Metals Site Rossville, Tennessee CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Fate and Transport	Figure No. 2–19 8/98

- **Transport by Rainwater Runoff:** During rainfall, water moves through contaminated media on the Site. Much of the storm-water runoff within the fenced portion of the Site is routed to the collection sump in the northeast corner and discharges off Site at this location. In addition, no stormwater collection facilities exist for the landfill area, and stormwater either infiltrates to groundwater or is routed north and east of the landfill. Runoff to the west is prevented due to the presence of the City of Rossville wastewater treatment ponds. These ponds are bermed, and runoff towards this area is routed north of the Site. Runoff from the Site may carry contaminated soils, as well as dissolved contaminants, into the Wolf River located about 0.5 miles north of the Site, although no data have been collected to support this conclusion. The Wolf River flows west, through Memphis, and into the Mississippi River.

The RM facility likely released lead in spills of battery acid, metallic or oxidized lead from improper storage or disposal of battery plates or casings, airborne fallout from the smelter, and the smelter slag.

The solubility of lead minerals and complexes increases as pH decreases (Lindsay 1979). No specific pH data for Site soils are available; however, a sustained leak of battery acid would neutralize soil alkalinity, lowering the soil pH and increasing lead mobility in the soil. At the RM Site, spills of battery acid may have transported lead deep into the soil profile and to the aquifer.

Lead was released to the environment as metallic lead or lead oxide. Metallic lead oxidizes slowly to lead oxide, and lead from airborne fallout is probably released to the environment as lead oxide. Lead oxides are relatively soluble when compared to lead sulfates, phosphates, and carbonates. The smelter slag contained very high concentrations of lead; however, the slag is relatively inert.

Metal mobility in soil-waste systems is determined by the type and quantity of soil surfaces present, contaminant concentrations, concentrations of competing ions and ligands, pH, and redox status. For this reason, the use of literature or laboratory data that do not mimic the specific Site soil and waste system are not generally adequate to describe or predict the behavior of the contaminant. In order to help determine the fate of lead contamination at the RM Site, several Site fate and transport models were completed as part of the EE/CA completed for the Site.

A one-dimensional geochemical model was used to evaluate (1) the migration of lead in soil beneath the smelter slag (2) the migration of lead below the contaminated soil near the wrecker building, and (3) a subsurface soil removal action level. The model suggested that the slag material is a potential source of contamination to groundwater; because it predicted that lead will migrate to groundwater in six years and the concentration of lead in groundwater will exceed 15 ug/l in 55 years. In addition the geochemical model suggested that soils near the wrecker building are acting as a continuing source of contamination to groundwater and that lead concentration in groundwater will continue to increase (reaching a maximum of 23,600 ug/l in 57 years) unless the source is removed.

A Hydrologic Evaluation of Landfill Performance (HELP) quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills, coupled with the results of the geochemical modeling suggest that the construction of a geosynthetic cap will effectively eliminate the potential for future groundwater contamination.

Finally, a Random-Walk model was completed to simulate the progress of remediation for the various remediation scenarios developed for the WHPA modeling. The Random-Walk modeling suggested that a 15 ug/l groundwater action level for lead cannot be attained under a "no action" scenario. However, the results of the Random-Walk modeling must be considered cautiously.

While the modeling efforts completed for the EE/CA and the RI/FS provide more Site-specific information regarding the fate and transport of lead contamination, the results should be used cautiously. The completed modeling applications are considered interpretive. Interpretive models are useful as a framework for studying system dynamics and for analyzing flow and transport in hypothetical or assumed hydrogeologic systems.

In addition to lead, other inorganics also were identified as human health or ecological COCs. Aluminum's behavior in the environment depends on its chemistry and surrounding conditions. In soils, a low pH generally results in an increase in aluminum mobility. Plants vary in their ability to remove aluminum from soils. Biomagnification of aluminum in terrestrial food chains does not appear to occur (ASTDR 1990).

Antimony's adsorption to soil and sediment is primarily correlated with iron, manganese, and aluminum content (ASTDR 1991). Antimony can be reduced and methylated by microorganisms in anaerobic sediment, releasing volatile methylated antimony compounds into water (ASTDR 1991).

Arsenic has four valence states (-3, 0, +3, +5) but rarely occurs in its free state in nature. Inorganic arsenic is more mobile than organic arsenic and poses greater problems by leaching into surface waters and groundwaters.

Lead does not magnify to a great extent in food chains. Older organisms typically contain the highest tissue lead levels (Eisler 1988). Plants can uptake lead through surface deposition in rain, dust, and soil, or by uptake through roots. A plant's ability to uptake lead from soils is inversely related to soil pH and organic matter content.

2.5.8 Treatability Studies

2.5.8.1 Dewatering Study, December 1997

A bench-scale dewatering treatability study on sediment was performed to evaluate different methods of reducing the water content of the untreated sediments and identify a treament which would improve the material handling qualities of the sediment such that free liquids are not released during transport and disposal.

The results of the initial dewatering tests determined that it would be difficult to effectively dewater these sediments. Silty materials have finer particle sizes resulting in less free drainage when dewatering. The gravity drainage test clearly demonstrated the difficulty encountered when attempting to use gravity to dewater these sediments. The silt fines prohibited the drainage of significant quantities of water from the sediments.

The most effective dewatering technique tested in terms of increasing the total solids in the sediment and removing the largest quantity of liquid, was filter press. The cake that resulted from the filter press test demonstrated why dewatering would not be the most effective treatment method for these sediments. The bottom layer (closest to the filtration device) was most effectively dewatered. Sediment above this layer had much higher water contents and would not have passed the liquid release test. This was a demonstration that the high fines in the silty material prohibit effective dewatering. In addition, the dewatering process took more than two hours using the filter press dewatering method.

The Buchner funnel test demonstrated that moderate success could likely be achieved using a belt filter press. However, the percent solids in the sediment only increased to 56 percent using this technique (untreated sediment 46 percent solids).

If dewatering is to be considered for sediment, additional testing using conditioning agent such as diatomaceous earth which would enhance the dewatering process would need to be used. While diatomaceous earth will not reduce leachability of the lead, it should enhance the release of free liquids from the sediments.

Given the high silt contents of these sediments, consideration of stabilization of these sediments is recommended. The stabilization process can be designed to improve the material handling characteristics of the sediment and reduce leachability of the sediment. Additional testing would be required to identify effective stabilization reagent(s).

2.5.8.2 Stabilization Study, March 1998

A stabilization study was performed to evaluate stabilization reagents that would 1) reduce the leachability of lead in treated sediment and 2) improve the material handling qualities of the sediment so that free liquids are not released during transport or disposal. The results of the treability study have determined that sediment can be treated using biosolids reagent N-Viro or phosphoric acid to reduce the leachability of lead. Treatment using N-Viro material absorbed free liquids after curing for 5 days and resulted in a material that could be excavated and transported for disposal.

Treatment using phosphoric acid, while reducing the leachability of lead, resulted in a material with free liquids and a noxious sulfide odor. Reduction in the addition rate of phosphoric acid did not reduce the sulfide odor.

The leachability of lead was decreased when the lower addition rates of CKD, LKD, and Fly Ash/PC were added to the sediment. Given the amphoteric nature of lead, it is possible that the solubility of lead in the sediment increased with the higher reagent addition rates. It is possible that the leachability would be reduced further if a 5 percent or lower addition rate was used. With the high water content in the sediment, an inert absorbent would be required along with the stabilization reagent to improve the handling characteristics.

The results of the stabilization study have demonstrated that this treatment process will effectively reduce the leachability of lead and improve the handling characteristics of the sediment. Considerations should be given to the method which the reagent is added to the sediment (in-situ or ex-situ) and the ultimate deposition of the treated sediment.

2.5.8.3 Biosolids Study, November 1998

The bench-scale column treatability study was performed to evaluate different methods of reducing lead contamination by adding biosolids material. Results indicate the lead concentration in the liquid fraction decreased from 5,400 to 2,100 ppb with an increase of biosolids to sediment ratio. Greater than 61.1 percent of lead concentration was reduced from biosolids to sediment rations of 0:5 and 1:4 which is less than the TCLP regulatory level [5.0 ppm]. The lead concentration remained the same (2,100 ppb) for biosolids to sediment ratios of 1:4 and 2:3. For another sample, the results indicate the lead concentrations in the liquid fraction were 230, 530, and 440 ppb for biosolids to sediment ratios of 0:5, 1:4, and 2:3, respectively. Based on this data and the 800 ppm goal, application of biosolids on the sediments appears to be feasible to sorb lead that may leach from the contaminated wetlands. Additional studies and tests will be required for confirmation.

2.6 SUMMARY OF SITE RISKS

2.6.1 Human Health Risk Assessment Summary

The primary purpose of this baseline risk assessment (BRA) is to provide a quantitative and qualitative understanding of the actual and potential risks to human health posed by the Ross Metals (RM) Site if no further remediation or institutional controls are applied. **The BRA consists of both a human health evaluation and an ecological risk assessment.**

2.6.1.1 Data Evaluation

Data used in this risk assessment were obtained from the following sources: May and November 1990, Environmental Services Division (ESD) Resource Conservation and Recovery Act (RCRA) investigations; 1994 Emergency Response and Removal Branch (ERRB) investigation during a time-critical removal action; 1995 Black & Veatch pre-remedial investigation; November 1996 ESD investigation; May 1997 PRC investigation; and 1997 Emergency Response Team Center (ERTC) investigation. These data were evaluated by ESD personnel and determined to be of acceptable quality for use in a Baseline Risk Assessment.

Because of the nature of the plant's operations, the majority of the samples were analyzed for Target Analyte List (TAL) parameters (inorganics) only. Two samples collected by ERTC were analyzed for the entire Target Compound List/Target Analyte List (TCL/TAL) parameters.

The laboratory results were validated by EPA Region 4 ESD personnel using standard data validation procedures. They concluded that with the exception of a small percentage of the data that were rejected for a variety of technical reasons, the overall data package can be accepted with confidence.

The data were then summarized to show all inorganic and organic chemicals that were positively identified in at least one sample. Included in this group were unqualified results and results that were qualified with a "J" which means the chemical was present but the concentration was estimated. These values were listed as actual detected concentrations which may have the effect of under- or over-estimating the actual concentration. Tentatively identified compounds (qualified with an "N") were included if there was reason to believe that they were present. For example, if a compound was positively identified in other locations, the tentative identification was considered sufficient.

These positively identified chemicals were then screened to exclude chemicals that, although present, are not important in terms of potential health effects. The screening criteria fall into three categories:

(1). Inorganics whose maximum detected concentration did not exceed two times the average background concentration were excluded;

(2). Inorganics that are essential nutrients or are normal components of human diets were excluded. Calcium, magnesium, potassium, and sodium were excluded because they are essential nutrients, with no known toxic effects at any relevant dosage level; and

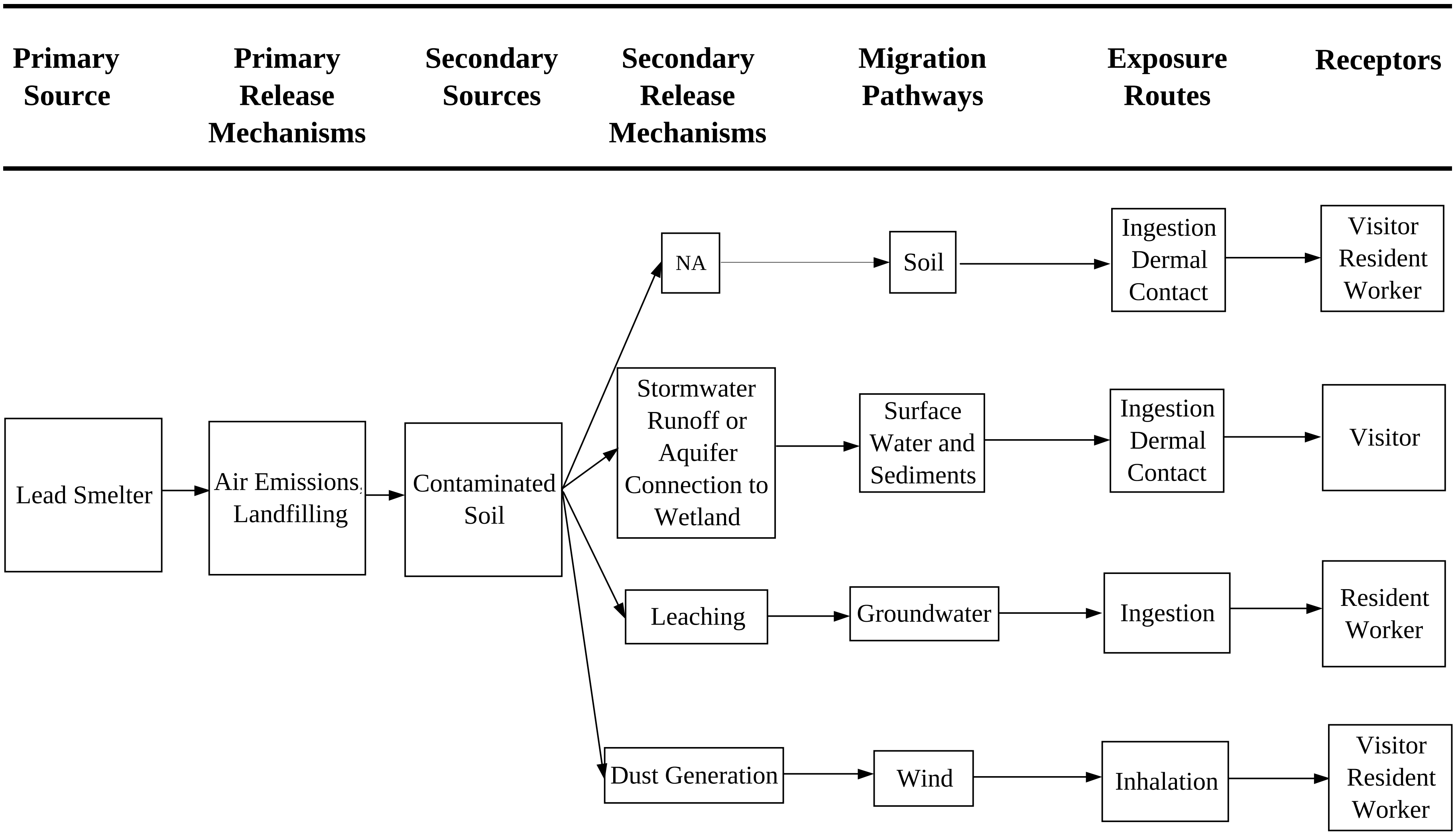
(3). Inorganic and organic chemicals whose maximum concentration was lower than a risk-based concentration corresponding to an excess cancer risk level of 1×10^{-6} or a Hazard Quotient (HQ) level of 0.1, as determined by EPA Region 3 toxicologists using residential land use assumptions, were excluded (EPA 1998b).

Since the overall site risk is the sum of risks from all relevant exposure routes (inadvertent ingestion of soil, dermal contact with soil, inhalation of dust, and ingestion of groundwater), eliminating one or more routes has the effect of reducing the apparent risk. The groundwater data that were used in this assessment contribute a significant degree of uncertainty to the overall assessment. Among the factors that should be considered is the substantial difference between the filtered and unfiltered samples (taken at the same location and time). This difference adds to the uncertainty in the exposure concentration and subsequent risk estimates. If this difference is due to turbidity, then the concentration of lead and other COPCs would change as the turbidity changes. This would result in an increase or decrease in the exposure concentration and resultant risk.

2.6.1.2 Exposure Pathways

The conceptual site model for this assessment is presented in **Figure 2-20**. As seen in this figure, metals, notably lead, are the primary contaminants of concern (COC) associated with the Site; these contaminants are found in soils, structures, groundwater, and surface water. These contaminants are not typically highly mobile in the environment and move primarily by sediment or wind transport. No specific pH data for Site soils are available; however, low pH will, in general, make metals more soluble and, therefore, more easily transportable from the Site, and more bioavailable.

Figure 2-20
Conceptual Site Model
Ross Metals Site
Rossville, Tennessee



Based on this understanding of the fate and transport of contaminants, and the potential for human contact, the following media/receptors were examined:

(1) Surficial soil/sediment in the Landfill Area and Wetland/Woodland Area. Potential receptors are Site visitors. In the future, residents and/or workers are potential receptors in the Process Area and Landfill Area.

(2) Surface water in the Wetland/Woodland Area. Potential receptors Site visitors.

(3) Groundwater beneath the Process Area and the Landfill Area. Potential receptors are future residents and/or workers.

Potentially complete exposure pathways examined in the risk assessment are:

- inadvertent ingestion of soil,
- dermal contact with soil,
- inhalation of dust,
- inadvertent ingestion of surface water,
- dermal contact with surface water, and
- ingestion of groundwater.

Reasonable maximum exposure (RME) point concentrations for soil/sediment, and surface water were calculated according to EPA Region 4 guidance using the lesser of the 95 percent upper confidence limit (UCL) on the arithmetic average for a lognormal distribution or the maximum detected value (EPA 1992a and 1995a). Where a chemical of concern was not detected at a given location, one-half the sample quantitation limit was used as a proxy concentration; however, if both the proxy concentration and the upper confidence limit exceeded the maximum detected value, the maximum detected value was used as the RME concentration. The RME concentrations for chemicals of concern are presented in **Table 2-3**.

Table 2-3 **Summary of Chemicals of Concern**						
Media	Chemical of Concern	Concentration Detected (in ppm)		Frequency of Detection	Exposure Point Concentration (in ppm)	Statistical Measure
		Min	Max			
Process Area						
Soil	Antimony	7	730	21/21	217	95% UCL
	Arsenic	3	479	25/26	99	95% UCL
	Barium	19	790	21/21	157	95% UCL
	Cadmium	0.1	99	16/26	99	Max
	Copper	6	712	18/21	238	95% UCL
	Lead	6	97,700	29/29	97,700	Max
	Selenium	1	48	7/21	8	95% UCL
Landfill Area						
Soil	Antimony	75	75	1/4	75	Max
	Arsenic	8	76	4/4	76	Max
	Cadmium	1	22	3/4	22	Max
	Lead	35	42,400	11/11	42,400	Max
	Manganese	380	1,100	4/4	1,100	Max
Wetland/Woodland Area						
Soil	Aluminum	3,390	24,000	46/46	13,331	95% UCL
	Antimony	1	1,350	14/42	32	95% UCL
	Arsenic	4	681	46/46	41	95% UCL
	Barium	53	610	46/46	147	95% UCL
	Cadmium	1	18	28/46	6	95% UCL
	Copper	8	465	45/46	43	95% UCL
	Iron	4,790	40,000	46/46	19,576	95% UCL
	Lead	67	98,100	52/52	5,827	95% UCL
	Manganese	25	1,500	46/46	752	95% UCL
	Selenium	2	84	13/46	4	95% UCL
	Vanadium	10	63	46/46	31	95% UCL

Table 2-3 Summary of Chemicals of Concern						
Media	Chemical of Concern	Concentration Detected (in ppm)		Frequency of Detection	Exposure Point Concentration (in ppm)	Statistical Measure
		Min	Max			
Site (Concentrations in ppb)						
Surface Water	Aluminum	168	1,300	7/10	1,300	Max
	Antimony	8	150	7/10	150	Max
	Arsenic	18	554	9/10	554	Max
	Cadmium	6	120	6/10	120	Max
	Copper	6	140	9/10	140	Max
	Iron	313	42,700	10/10	42,700	Max
	Lead	36	16,000	10/10	16,000	Max
	Manganese	229	5,520	10/10	5,520	Max
	Mercury	0.2	0.4	4/10	0.4	Max
	Selenium	7	11	2/10	7	95% UCL
	Thallium	13	13	3/10	13	Max
	Zinc	39	568	7/10	568	Max
Groundwater	Aluminum	380	23,000	9/14	2,608	Ave
	Arsenic	21	40	2/24	20	Ave
	Barium	11	380	14/14	90	Ave
	Cadmium	5	7	3/14	2	Ave
	Chromium	39	39	1/14	6	Ave
	Iron	1,300	64,000	10/14	12,126	Ave
	Lead	3	1,600	18/24	196	Ave
	Manganese	130	5,600	10/14	1,472	Ave
	Nickel	45	160	4/14	24	Ave
	Vanadium	7	49	3/14	6	Ave

UCL: Upper Confidence Limit

Max: The highest detected concentration

Ave: Average concentration within the plume

2.6.1.3 Toxicity Values

The RfDs and CSFs used in this assessment were primarily obtained from EPA's IRIS database (EPA 1998c). Values that appear in IRIS have been extensively reviewed by EPA work groups and thus represent Agency consensus. If no values for a given compound and route of exposure were listed in IRIS, then EPA's HEAST (EPA 1995b) were consulted. Where no value was listed in either IRIS or HEAST, EPA's National Center for Environmental Assessment (formerly the Environmental Criteria and Assessment Office) was consulted. **Tables 2-4** and **2-5** summarize the toxicity values for carcinogenic and non-carcinogenic COCs, respectively.

Neither a CSF nor an RfD is available for lead. Instead, blood lead concentrations have been accepted as the best measure of exposure to lead. Because children are the most vulnerable to lead toxicity, EPA has developed an integrated exposure uptake biokinetic model (IEUBK) to assess chronic, non-carcinogenic exposures of children to lead. When this model is used, and the detected concentrations are shown to be acceptable to the most vulnerable group in the population (children), it is not necessary to address adult exposure.

To characterize risk associated with dermal exposure, the toxicity values presented in Tables 2-4 and 2-5 were adjusted from administered to absorbed toxicity factors according to the method described in Appendix A to RAGS (EPA 1989a). The following oral absorption percentages were employed: 80 percent for VOCs, 50 percent for semi-volatile organics, and 20 percent for inorganics (EPA

Table 2-4
Cancer Slope Factor

Chemical of Concern	CsFo	ABSeff	CSFd	CSFi	Tumor Sites	EPA Class
Aluminum	NA	20%	NA	NA	NA	D
Antimony	NA	20%	NA	NA	NA	D
Arsenic	1.5E+00 i	100%	NA	NA	Skin	A
Barium	NA	20%	NA	NA	NA	D
Cadmium	NA	20%	NA	6.3E+00 i	Lung	B1
Chromium	NA	20%	NA	4.2E+01 i	Lung	A
Copper	NA	20%	NA	NA	NA	D
Iron	NA	20%	NA	NA	NA	D
Lead	NA	20%	NA	NA	Kidney	B2
Manganese	NA	20%	NA	NA	NA	D
Mercury	NA	20%	NA	NA	NA	D
Selenium	NA	20%	NA	NA	NA	D
Thallium	NA	20%	NA	NA	NA	D
Vanadium	NA	20%	NA	NA	NA	D
Zinc	NA	20%	NA	NA	NA	D

Source:
i - IRIS
CSFo - Cancer Slope Factor (oral), (mg/kg/day)-1
CSFd - Cancer Slope Factor (dermal), (mg/kg/day)-1
ABSeff - Absorption efficiency: 20% inorganics, 50% semivolatiles, 80% volatiles. Based on RIV policy.
CSFi - Cancer Slope Factor (inhalation), (mg/kg/day)-1
NA - Not Applicable

EPA Cancer Classes

A - Human carcinogen
B - Probable human carcinogen
C - Possible Human carcinogen
D - Not classifiable as a human carcinogen

Table 2-5
Reference Dose

Chemical of Concern	RfDo	ABSeff	RfDd	RfDi	Target Sites/Effects
Aluminum	1E+00 n	20%	2E-01	NA	Not specified
Antimony	4E-04 i	20%	8E-05	NA	Longevity, blood glucose
Arsenic	3E-04 i	100%	3E-04	NA	Hyperpigmentation
Barium	7E-02 i	20%	1E-02	NA	Incr. blood pressure
Cadmium (water)	5E-04 i	20%	1E-04	NA	Proteinuria
Cadmium (food)	1E-03 i	20%	2E-04	NA	Proteinuria
Chromium	5E-03 i	20%	1E-03	4.2E+01 i	NOAEL
Copper	4E-02 n	20%	8E-03	NA	Not specified
Iron	3E-01 n	20%	6E-02	NA	NOAEL
Lead	NA	20%	NA	NA	CNS effects, blood
Manganese (soil)	7E-02 IV	20%	1E-02	1.43E-05	NOAEL
Manganese (water)	2.4E-02 IV	20%	NA	NA	Neurotoxicity
Mercury	3E-04 i	20%	6E-05	NA	Neurortoxicity
Selenium	5E-03 i	20%	1E-03	NA	Clinical selenosis
Thallium	9E-05 i	20%	2E-05	NA	Incr. SGOT and LDH
Vanadium	7E-03 i	20%	1E-03	NA	Decr. hair cystine
Zinc	3E-01 i	20%	6E-02	NA	Decr. ESOD

Sources:
i - IRIS
n - NCEA (National Center for Environmental Assessment)
IV - The RfDo for manganese in IRIS is 1.4E-1 mg/kg/day based on the NOAEL of 10 mg/day. For soil exposure, Region IV policy is to subtract the average daily dietary exposure (5 mg/d) from the NOAEL to determine a “soil” RfDo. When this is done, a “soil” RfDo of 7E-2 mg/kg/day results. For water exposure, a neonate is considered a sensitive receptor for the neurological effects of manganese. Thus caution, (in the form of a modifying factor) is warranted until more data are available. Using a modifying factor of 3 results in a “water” RfDo of 2.4E-2 mg/kg/day.

RfDo - Reference Dose (oral), (mg/kg/day)
RfDd - Reference Dose (dermal), (mg/kg/day)
ABSeff - Absorption efficiency: 20% inorganics, 50% semivolatiles, 80% volatiles. Based on RIV policy.
RfDi -Reference Dose (inhalation), (mg/kg/day)
NA - Not Applicable

1995a). The only exception to this was for arsenic. According to recently released EPA Region 4 guidance, the gastrointestinal absorption rate of arsenic may be considered 100 percent (Koporec 1998). Thus, when considering dermal exposure to arsenic, no adjustment is necessary.

2.6.1.4 Risk Characterization

The final step of the baseline risk assessment is the risk characterization. Human intakes for each exposure pathway are integrated with EPA reference toxicity values to characterize risk. Carcinogenic, non-carcinogenic, and lead effects are estimated separately.

To characterize the overall potential for non-carcinogenic effects associated with exposure to multiple chemicals, EPA uses a Hazard Index (HI) approach. This approach assumes that simultaneous subthreshold chronic exposures to multiple chemicals that affect the same target organ are additive and could result in an adverse health effect. The HI is calculated as follows:

$$\text{Hazard Index} = ADD_1/RfD_1 + ADD_2/RfD_2 + ...ADD_i/RfD_i$$

where: ADD_i = Average Daily Dose (ADD) for the ith toxicant

RfD_i = Reference Dose for the ith toxicant

The term ADD_i/RfD_i is referred to as the Hazard Quotient (HQ).

Calculation of an HI in excess of unity indicates the potential for adverse health effects. Indices greater than one will be generated anytime intake for any of the Chemicals of Potential Concern (COPC). However, given a sufficient number of chemicals under consideration, it is also possible to generate an HI greater than one even if none of the individual chemical intakes exceeds its respective RfD.

Carcinogenic risk is expressed as a probability of developing cancer as a result of lifetime exposure. For a given chemical and route of exposure, excess lifetime cancer risk is calculated as follows:

Risk = Lifetime Average Daily Dose (LADD) x Carcinogenic Slope Factor (CSF)

These risks are probabilities that are generally expressed in scientific notation (i.e., 1×10^{-6} or 1E-6). An incremental lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper-bound, an individual has a one-in-one-million chance of developing cancer as a result of Site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at the Site. For exposures to multiple carcinogens, EPA assumes that the risk associated with multiple exposures is equivalent to the sum of their individual risks.

Process Area: Current Use Risk Summary

The Process Area presents physical and chemical risks to human health. The Site contains numerous unstable structures that pose physical risks to trespassers. Incidents involving unstable structures are potentially fatal and represent significant risk associated with the Site. The condition of the structures will worsen over time, with a corresponding increase in associated hazards.

Apart from the physical hazards noted above, exposure to contaminants in soil in the Process Area is curtailed by the asphalt pavement that covers the great majority of the Site and exposure to contaminated soils is not possible. Also, there are no groundwater wells in use that tap the contaminated zone of the aquifer. Thus, for these reasons, current exposure routes are incomplete.

Process Area: Future Use Risk Summary

In the future, the Site may be redeveloped for either residential or commercial/industrial use based on dialogue with local land use planning officials and citizens. Such redevelopment would expose the contaminated soils that exist beneath the pavement. Potential receptors would be Site visitors, Site workers, child residents, adult residents, and lifetime residents. Exposure routes potentially complete in such a scenario are:

- inadvertent ingestion of soil;
- dermal contact with soil; and
- inhalation of dust
- ingestion of groundwater

Table 2-6 summarizes the cancer and noncancer risks for these receptors. The total incremental lifetime cancer risk estimates range from 3 x 10E-9 for the Site visitor to 5 x 10E-4 for the lifetime resident. In addition to the lifetime resident, risk estimates for the child resident and adult resident are above EPA's target range for Superfund sites. Arsenic in groundwater accounts for the excess cancer risk. Noncancer effects are possible for Site workers, child, adult, and lifetime residents based on HIs of 2, 25, 7, and 10 respectively. Exposure to antimony, arsenic, and iron, and manganese in groundwater account for the majority of the potential non-cancer effects. **Table 2-7** summarizes the cancer and noncancer risks for these receptors when the ingestion of groundwater route is eliminated.

Process Area: Exposure to Lead

In the future, the Site may be redeveloped for either residential or commerical/industrial use. Such redevelopment would expose the contaminated soils that exist beneath the pavement. Potential receptors would be Site visitors, Site worker, child residents, adult residents, and lifetime residents. In this future scenario, ingestion of groundwater from wells developed from within the contaminant plume is considered as an additional exposure route for Site workers, child residents, adult residents, and lifetime resident. Exposure routes potentially complete in such a scenario are:

Table 2-6
Summary of Cancer and Noncancer Risks by Exposure Route
Future Use Scenario
Process Area
Ross Metals Site
Rossville, Tennessee

Exposure Route	**Site Visitor**		**Site Worker**		**Child Resident**		**Adult Resident**		**Lifetime Resident**	
	Cancer	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**
Ingestion Grou	NA	NA	1E-004	2	2E-004	12	3E-004	5	5E-004	7
Inadvertent In	NA	0.3	NA	0.5	NA	13	NA	1	NA	4
Dermal Conta	NA	0.1	NA	0.2	NA	1	NA	0.3	NA	0.3
Inhalation Dus	3E-009	0.0001	3E-008	0.0004	3E-008	0.001	4E-008	0.001	7E-008	0.001
TOTAL RISK	**3E-009**	**0.4**	**1E-004**	**2**	**2E-004**	**25**	**3E-004**	**7**	**5E-004**	**10**

Cancer: Excess cancer risk level
HI: Hazard index (non-cancer risk)
NA: not applicable

Table 2-7
Summary of Cancer and Noncancer Risks by Exposure Route
Future Use Scenario (w/o Groundwater Pathway)
Process Area
Ross Metals Site
Rossville, Tennessee

Exposure	**Site Visitor**		**Site Worker**		**Child Resident**		**Adult Resident**		**Lifetime Resident**	
Route	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**
Inadvertent In	NA	0.3	NA	0.5	NA	13	NA	1	NA	4
Dermal Conta	NA	0.1	NA	0.2	NA	1	NA	0.3	NA	0.3
Inhalation Du	3E-009	0.0001	3E-008	0.0004	3E-008	0.001	4E-008	0.001	7E-008	0.001
TOTAL RISK	**3E-009**	**0.4**	**3E-008**	**1**	**3E-008**	**13**	**4E-008**	**2**	**7E-008**	**4**

Cancer: Excess cancer risk level
HI: Hazard index (non-cancer risk)
NA: not applicable

- inadvertent ingestion of soil,
- dermal contact with soil,
- inhalation of dust, and
- ingestion of groundwater.

Lead was detected in all Process Area soil samples at concentrations ranging from 6 to 97,700 ppm; the average concentration was 8,788 ppm. Lead was also detected in Site groundwater at concentrations of 3 to 1,600 µg/l; the average concentration was 196 µg/l. These values were input into version 0.99d of the IEUBK model. The results are summarized in **Table 2-8**. An additional model run was conducted with a default value of 4 ug/l for groundwater as an input. The results are summarized in **Table 2-9**. EPA uses a level of 10 µg lead per deciliter (dl) blood as the benchmark to evaluate lead exposure. As can be seen, the projected blood lead levels exceeded this threshold for all age groups, indicating that lead concentrations are above the acceptable range.

Landfill Area: Future Risk Summary

In the future, the Landfill Area may be redeveloped for commercial/industrial use or it may be converted to residential use. Ingestion of groundwater is an additional exposure route that may exist in a future use scenario. **Table 2-10** summarizes the cancer and noncancer risks for the Site visitor, Site worker, child resident, adult resident, and lifetime resident. The total incremental lifetime cancer risk estimates range from 8×10^{-10} for the Site visitor to 5×10^{-4} for the lifetime resident. In addition to the lifetime resident, the risk estimate for the adult resident is above EPA's target range for Superfund sites. Arsenic in groundwater accounts for the excess cancer risk. Noncancer effects are possible for Site workers, and child, adult, and lifetime residents based on HIs of 2, 18, 6, and 8, respectively. Exposure to arsenic, antimony, and cadmium in soil and arsenic, iron, and manganese in groundwater account for the majority of the potential non-cancer effects. **Table 2-11** summarizes the cancer and noncancer risks excluding the groundwater pathway.

Table 2-8
Projected Blood Lead Levels by Age Group
Process Area
Ross Metals Site
Rossville, Tennessee

Blood Lead Levels (ug/dl)						
Year 0.5-1	**Year 1-2**	**Year 2-3**	**Year 3-4**	**Year 4-5**	**Year 5-6**	**Year 6-7**
40.5	47.4	45.7	45.4	41.4	38	35.4

Source: Integrated Exposure Uptake Biokinetic Model for Lead in Children, version 0.99d.

Assumptions:
Air concentration: 0.200 ug Pb/m3 (default)
Diet (default)
Soil and dust: 8,788 ug/g (average lead concentration in soil); Multiple Source Analysis
Drinking water: 196 ug/l (average concentration in plume)
Paint intake: 0.00 ug Pb/day (default)
Maternal contribution: Infant model (default)

Table 2-9
Projected Blood Lead Levels by Age Group
Process Area (w/o Groundwater Pathway)
Ross Metals Site
Rossville, Tennessee

Blood Lead Levels (ug/dl)						
Year 0.5-1	**Year 1-2**	**Year 2-3**	**Year 3-4**	**Year 4-5**	**Year 5-6**	**Year 6-7**
38.4	43.9	42.0	41.7	37.2	33.3	30.5

Source: Integrated Exposure Uptake Biokinetic Model for Lead in Children, version 0.99d.

Assumptions:
Air concentration: 0.200 ug Pb/m3 (default)
Diet (default)
Soil and dust: 8,788 ug/g (average lead concentration in soil); Multiple Source Analysis
Drinking water: 4 ug/l (default)
Paint intake: 0.00 ug Pb/day (default)
Maternal contribution: Infant model (default)

Table 2-10
Summary of Cancer and Noncancer Risks by Exposure Route
Future Use Scenario
Landfill Area
Ross Metals Site
Rossville, Tennessee

Exposure Route	Site Visitor		Site Worker		Child Resident		Adult Resident		Lifetime Resident	
	Cancer	HI	Cancer	HI	Cancer	HI	Cancer	HI	Cancer	HI
Ingestion Grou	NA	NA	1E-004	2	2E-004	12	3E-004	5	5E-004	7
Inadvertent In	NA	0.1	NA	0.2	NA	6	NA	1	NA	2
Dermal Conta	NA	0.02	NA	0.1	NA	0.2	NA	0.1	NA	0.1
Inhalation Dus	8E-010	0.003	7E-009	0.01	6E-009	0.04	1E-008	0.02	2E-008	0.02
TOTAL RISK	**8E-010**	**0.2**	**1E-004**	**2**	**2E-004**	**18**	**3E-004**	**6**	**5E-004**	**8**

Cancer: Excess cancer risk level
HI: Hazard index (non-cancer risk)
NA: not applicable

Table 2-11
Summary of Cancer and Noncancer Risks by Exposure Route
Future Use Scenario (w/o Groundwater Pathway)
Landfill Area
Ross Metals Site
Rossville, Tennessee

Exposure Route	**Site Visitor**		**Site Worker**		**Child Resident**		**Adult Resident**		**Lifetime Resident**	
	Cancer	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**	**Cancer**	**HI**
Inadvertent In	NA	0.1	NA	0.2	NA	6	NA	1	NA	2
Dermal Conta	NA	0.02	NA	0.1	NA	0.2	NA	0.1	NA	0.1
Inhalation Dus	8E-010	0.003	7E-009	0.01	6E-009	0.04	1E-008	0.02	2E-008	0.02
TOTAL RISK	**8E-010**	**0.2**	**7E-009**	**0**	**6E-009**	**6**	**1E-008**	**1**	**2E-008**	**2**

Cancer: Excess cancer risk level
HI: Hazard index (non-cancer risk)
NA: not applicable

Table 2-12
Projected Blood Lead Levels by Age Group
Landfill Area
Ross Metals Site
Rossville, Tennessee

Blood Lead Levels (ug/dl)						
Year 0.5-1	**Year 1-2**	**Year 2-3**	**Year 3-4**	**Year 4-5**	**Year 5-6**	**Year 6-7**
33.4	39.6	38.3	38.1	34.9	32.1	29.9

Source: Integrated Exposure Uptake Biokinetic Model for Lead in Children, version 0.99d.

Assumptions:
Air concentration: 0.200 ug Pb/m3 (default)
Diet (default)
Soil and dust: 5,964 ug/g (average lead concentration in soil); Multiple Source Analysis
Drinking water: 196 ug/l (average concentration in plume)
Paint intake: 0.00 ug Pb/day (default)
Maternal contribution: Infant model (default)

Table 2-13
Projected Blood Lead Levels by Age Group
Landfill Area (w/o Groundwater Pathway)
Ross Metals Site
Rossville, Tennessee

Blood Lead Levels (ug/dl)						
Year 0.5-1	**Year 1-2**	**Year 2-3**	**Year 3-4**	**Year 4-5**	**Year 5-6**	**Year 6-7**
30.9	35.4	33.9	33.6	29.7	26.4	24.0

Source: Integrated Exposure Uptake Biokinetic Model for Lead in Children, version 0.99d.

Assumptions:
Air concentration: 0.200 ug Pb/m3 (default)
Diet (default)
Soil and dust: 8,788 ug/g (average lead concentration in soil); Multiple Source Analysis
Drinking water: 4 ug/l (default)
Paint intake: 0.00 ug Pb/day (default)
Maternal contribution: Infant model (default)

11.0 DETAILED ANALYSIS OF ALTERNATIVES

For surface soil, all six alternatives were carried through the screening process presented in Section 10.0. These are:

- Alternative 1 No Action
- Alternative 2 Capping
- Alternative 3 Capping with Pavement in Place
- Alternative 4 Capping with Construction of Above-Ground Disposal Cell
- Alternative 5 A/B Excavation and Onsite Treatment with Solidification/Stabilization
- Alternative 6 A/B Capping with Excavation and Onsite Treatment of Principal Threat Waste

For wetland sediment, three alternatives were carried through the screening process. Renumbered, they are:

- Alternative 1 No Action
- Alternative 2 Capping with Clean Fill and Off-site Creation of Wetlands
- Alternative 3 A/B Excavation and Revegetation/Restoration of Wetlands

For groundwater, three alternatives were carried through the screening process. Renumbered, they are:

- Alternative 1 No Action
- Alternative 2 Limited Action
- Alternative 3 A/B/C/D Pump & Treat With Physical and/or Chemical Treatment

Those alternatives not selected may be reconsidered at a later step during the remedial design phase if information is developed that identified an additional advantage not previously apparent, or as an alternative for a similar retained alternative that continues to be evaluated favorably.

In accordance with the NCP, the retained alternatives described in Section 10.0 were evaluated against the nine criteria as described below.

Overall Protection of Human Health and the Environment

Each alternative was assessed to determine whether it can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to levels established during development of remediation goals. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

Each alternative was assessed to determine whether it will attain ARARs under federal and state environmental or facility siting laws, or provide grounds for invoking one of the waivers.

Long-Term Effectiveness and Permanence

Each alternative was assessed for the long-term effectiveness and permanence it presents, along with the degree of certainty that the alternative will prove successful. Factors considered as appropriate included the following:

- Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their M/T/V and propensity to bioaccumulate.

- Adequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage treatment residuals and untreated waste. This factor addresses the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative; and the potential exposure pathways and risks posed should the remedial action need replacement.

Reduction of M/T/V Through Treatment

The degree to which each alternative employs recycling or treatment that reduces M/T/V was assessed, including how treatment is used to address the principal threats posed by the site. Factors considered as appropriate included the following:

- the treatment or recycling processes the alternatives employ and the materials they will treat;
- the amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled;
- the degree of expected reduction of M/T/V of the waste due to treatment or recycling and the specification of which reduction(s) are occurring;
- the degree to which the treatment is irreversible;
- the type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccummulate such hazardous substances and their constituents; and
- the degree to which treatment reduces the inherent hazards posed by principal threats at the site.

Short-Term Effectiveness

The short-term effectiveness of each alternative were assessed considering the following:

- short-term risks that might be posed to the community during implementation of an alternative;
- potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;
- potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and
- time until protection is achieved.

Implementability

The ease or difficulty of implementing each alternative was assessed by considering the following types of factors as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy.

- Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (e.g. offsite disposal).

- Availability of services and materials, including the availability of adequate offsite treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and availability of prospective technologies.

Cost

The types of costs that were assessed include the following:

- Capital costs, including both direct and indirect costs;
- Annual O&M; and
- Net present worth of capital and O&M costs.

The present worth of each alternative provides the basis for the cost comparison. The present worth cost represents the amount of money that, if invested in the initial year of the remedial action at a given rate, would provide the funds required to make future payments to cover all costs associated with the remedial action over its planned life.

The present worth analysis was performed on all remedial alternatives using a 7% discount rate over a period of 30 years. Inflation and depreciation were not considered in preparing the present worth costs. **Appendix O** contains spreadsheets showing each component of the present worth costs.

State Acceptance

Assessment of State concerns will not be completed until comments on the RI/FS report are received but may be discussed, to the extent possible, in the proposed plan issued for public comment. The State concerns that shall be assessed include the following:

- the State’s position and key concerns related to the preferred alternative and other alternatives, particularly, the State's as well as the U.S. Fish and Wildlife Service's concerns regarding the proposed destruction and revegetation of wetlands; and
- State comments on ARARs or the proposed use of waivers.

Community Acceptance

This assessment includes determining which components of the alternatives interested persons in the community support, have reservations about, or categorically reject. This assessment will not be completed until comments on the proposed plan are received.

11.1 ANALYSIS OF ALTERNATIVES

In order to establish priority among these criteria, they are separated into three groups. The first two criteria listed are threshold criteria, and must be satisfied by the remedial action alternative being considered. The next five criteria are secondary criteria used as balancing criteria among those alternatives which satisfy the threshold criteria. The last two criteria are not evaluated during the FS. State and community acceptance is evaluated by EPA during the public comment period of the proposed plan, and an EPA responsiveness summary is incorporated into the Record of Decision. The objective of this section is to evaluate each of the alternatives for site remediation, individually on the basis of the threshold and balancing criteria. A summary of this analysis is presented in **Tables 11-1 through 11-3**. A comparative analysis of how the seven criteria are satisfied by each of the alternatives is presented in Section 12.0.

11.1.1.1 Alternative 1 -- No Action

Overall Protection of Human Health and the Environment

The no action alternative does not eliminate any exposure pathways or reduce the level of risk of the existing soil contamination.

Compliance with ARARs

This alternative does not achieve the RAOs or chemical-specific ARARs established for surface soil. Location- and action-specific ARARs do not apply to this alternative since further remedial actions will not be conducted.

Long-Term Effectiveness and Permanence

The remediation goals derived for protection of human health and the environment would not be met. Because contaminated soil remains under this alternative, a review/reassessment of the conditions at the site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

Table 11-1

Summary of Soil Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	$100,247
2 -- Capping	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,735,804 Opt.2-$1,712,412
3 -- Capping With Pavement In Place	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,453,803 Opt.2-$1,430,411
4 -- Capping With Construction of Above-Ground Disposal Cell	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,506,847 Opt.2-$1,481,865

Note: Option 1 includes excavated wetland sediment; Option 2 does not.

Table 11-1(cont)

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
5A -- Excavation and Onsite Treatment With Solidification/ Stabilization and Onsite Disposal	Eliminates exposure pathways and reduces the level of risk. Immobilizes contamination and eliminates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1- $4,907,274 Opt.2-$4,244,992
5B -- Excavation and Onsite Treatment With Solidification/ Stabilization and Offsite Disposal	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	ARARs are met through onsite treatment and offsite disposal.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	None	<1	Opt.1-$7,477,199 Opt.2-$6,181,160
6A -- Capping With Excavation and Onsite Treatment And Disposal Of Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$3,175,137 Opt.2-$2,729,543
6B -- Capping With Excavation and Onsite Treatment And Offsite Disposal Of Treated Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain	<1	Opt.1-$4,936,044 Opt.2-$4,013,508

Note: Option 1 includes excavated wetland sediment; Option 2 does not.

Table 11-2

Summary of Wetland Sediment Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability: Technical/Engineering Considerations	Implementability: Estimated Time for Implementation (years)	Cost Approx. Total Present Worth
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	$100,247
2 -- Capping w/Clean Fill and Off-site Creation of Wetlands	Potentially eliminates multiple exposure pathways to ecological receptors. Organisms utilizing portions of the wetlands below the surface may potentially continue to be exposed.	Does not meet ARARS for protection of wetlands.	Will reduce or eliminate viable exposure pathways and prevent degradation of adjacent wetlands No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain and wetlands.	<1	$611,762
3 A -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Clean Fill	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity, and volume is achieved through removal, not treatment.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None	<1	$780,071
3 B -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Biosolid Compost	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity,and volume is achieved through removal, not treatment. Additionally, use of biosolid compost reduces toxicity by limiting bioavailability of contaminants.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None.	<1	$699,548

Table 11-3
Summary of Groundwater Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated groundwater is a long-term impact. The remediation goals and MCLs are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	$86,597
2 -- Limited Action	Unless contingency component is implemented, does not eliminate exposure pathways. Minimally reduces the level of risk.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply unless contingency component is implemented.	The contaminated groundwater is a long-term impact. The remediation goals and MCLs are not met.	No reduction of M/T/V is realized, unless contingency component is implemented.	Level D protective equipment is required during sampling.	Additional data collection needed to determine aquifer characteristics and vertical extent of contamination. Treatability study may be needed to develop contingency treatment component.	<1	$498,095
3 -- Pump & Treat With Physical and/or Chemical Treatment	Eliminates exposure pathways and reduces the level of risk. Reduces contamination and eliminates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with groundwater are eliminated. No residual risks from the alternative.	Mobility ,toxicity and volume are reduced.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Additional data collection required to determine aquifer characteristics and vertical extent of contamination. Treatability study may be needed to define treatment component.	5-12	A -- $1,359,116 B -- $1,185,719 C -- $867,484 D -- $1,652,450

Note: Scenarios A,B, C, and D refer to four different extraction system setups.

Reduction of M/T/V Through Treatment

No reductions in contaminants M/T/V are realized under this alternative.

Short-Term Effectiveness

Since no further remedial action would be implemented at this site, this alternative poses no short-term risks to onsite workers. It is assumed that Level D personnel protection would be used when sampling various media.

Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

11.1.1.2 Alternative 2 -- Capping

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) minimizing the migration of contaminants to groundwater and eliminating the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the site would be demolished and disposed of in an excavated disposal area beneath the existing pavement. As a result, physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with

existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,
- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,
- the landfill will not cause or contribute to significant degradation of wetlands,

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented in order to maintain effectiveness.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the site. Consolidation and capping would isolate waste source areas and would reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous site investigations, 600 CY of surface soil and 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and site conditions does not suggest that these situations would apply to the RM site.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than the capping of contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 2 is approximately $1,735,804 for Option 1, which includes the excavated wetlands sediment, and $1,712,412 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,575,908, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,552,516, and the estimated O&M cost is approximately $159,895.Detailed cost estimates are in Appendix O.

11.1.1.3 <u>Alternative 3 -- Capping With Pavement In Place</u>

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative 2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood.   In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with

existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain

- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,

- the landfill will not cause or contribute to significant degradation of wetlands,

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would to need be periodically inspected, and required maintenance would need to be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and site conditions does not suggest that these situations would apply to the RM site.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 3 is approximately $1,453,803 for Option 1, which includes the excavated wetlands sediment, and $1,430,411 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,293,907, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,270,515, and the estimated O&M cost is approximately $159,895. Detailed cost estimates are in Appendix O.

11.1.1.4 Alternative 4 -- Capping With Construction Of Above-Ground Disposal Cell

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative 2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted over the landfill area. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with

existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,
- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,
- the landfill will not cause or contribute to significant degradation of wetlands,

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991).

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and site conditions does not suggest that these situations would apply to the RM site.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 4 is approximately $1,506,847 for Option 1, which includes the excavated wetlands sediment, and $1,481,865 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,346,951, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,321,970, and the estimated O&M cost is approximately $159,895. Detailed cost estimates are in Appendix O.

11.1.1.5 Alternative 5 -- Excavation and Onsite Treatment With Solidification/Stabilization

11.1.1.5.1 Option A - Onsite Disposal

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would eliminate risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) eliminating the migration of contaminants to groundwater and surface water. The threat of direct human exposure to contaminated waste and physical hazards would be eliminated by this alternative. Treatment of the waste material would eliminate contaminant exposure through the receptor routes of ingestion and inhalation. Contaminated soil and slag would be treated and converted to a nonhazardous material. Structures throughout the site would be demolished and either disposed of in an excavated disposal area beneath the existing pavement or recycled. As a result, physical hazards associated with deteriorating structures would be eliminated. Waste immobilized by treatment or removed by decontamination would eliminate contaminant migration from the site.

Compliance with ARARs

The State of Tennessee SWPD rules are potentially applicable. The State may classify the on-site disposal area for treated waste as a Class II (industrial waste) landfill facility. Class II facilities must meet the same requirements as Class I (solid waste) disposal facilities unless a waiver of one or more of the standards is obtained as set forth in SWPD Rule 1200-1-7-.01(5). Class I standards include requirements for landfill liners, geologic buffers, leachate collection systems, and other requirements that may not be necessary for the RM site to be protective of human health and the environment. The SWPD rule also includes buffer zone standards for Class II facilities. These standards require that new facilities be located so that fill areas are, at a minimum, 100 feet from all property lines and 500 feet from all residences unless the owner agrees in writing to a shorter distance. A disposal area that is constructed to be about 700 feet by 250 feet would likely meet both the buffer zone and capacity requirements for the RM site.

The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains.

Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,

- the landfill will not cause or contribute to significant degradation of wetlands,

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The Protection of Wetlands Order (40 CFR 6) also requires that no adverse impacts to wetlands result from a remedial action. Historical evidence suggests that the existing landfill was created in a wetland. However, this area was not observed to contain standing water during sampling events conducted in 1996 and 1997. It is not known whether the area of the existing landfill would be classified as a wetland area.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this removal action.

All action-specific ARARs are expected to be met. The Tennessee Air Pollution Air Control Regulations (TAPCR) dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. If remedial equipment is used on site such as a pugmill mixer or crusher, dust and vapors generated from the use of this equipment will be contained and treated before being discharged to the atmosphere, if required. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

If the disposal area is classified as a Class II disposal facility, the area may have to be maintained to ensure that it continues to perform as designed; consequently, monitoring, inspection, and maintenance would be required. The soil cover area would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected, and required maintenance could be implemented.

If the RM site is not classified as a Class II disposal facility; monitoring, inspection, and maintenance may not be required. Treatment reagents are typically tested by the Multiple Extraction Procedure (MEP, SW-846 Method 1320) to measure long-term stability. The test is intended to approximate leachability under acidic conditions over a 1,000-year time frame. Based on successful completion of bench-scale testing that would include MEP analysis, this alternative is expected to provide adequate long-term effectiveness and permanence. Access restrictions such as land use controls and fencing may be required to prevent land uses incompatible with the site.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant toxicity and mobility through treatment; contaminant volume would not be reduced. Contaminant toxicity would be reduced by altering the physical or chemical structure of the contaminant into a nonhazardous material. Contaminant mobility would be reduced by binding or bonding the contaminant into a nonleachable form that would eliminate contaminant migration from the site. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative meets EPA's expectation to use treatment to address the principal threats posed by a site by treating all the contaminated soil, sediment, and slag. However, treatment of what would be considered low-level threat waste does not meet EPA's expectation to use containment to address such waste, although in some situations, treatment rather than containment of low-level threats is warranted (EPA 1991).

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation, consolidation, and treatment of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the decontamination and demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Treatment of contaminated soil and slag is offered by numerous vendors. On-site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 20 percent.

The dimensions of the site property are about 450 by 800 feet, including the existing landfill. The waste storage capacity required for this alternative is 49,150 CY assuming a 20 percent volume increase of the treated material. To meet the SWDP buffer zone siting standards, the excavation area would be 700 by 250 feet, and with an 8-ft average depth, depending on the thickness of the clay unit. The disposal area would be located beneath the existing pavement.

Wastewater may be generated during implementation of this alternative through water runoff generated as a result of dust emission control. Wastewater may also be generated as a result of decontamination activities required for equipment and on-site workers. Containment and treatment or disposal of these wastewaters may be required. Depending upon the treatment methodology selected, the wastewater may be able to be utilized in the soils treatment process.

The on-site disposal area for the treated waste may be classified as a Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities would apply to the site.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 5A is approximately $4,907,274 for Option 1, which includes the excavated wetlands sediment, and $4,244,992 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $4,743,474, and the estimated O&M cost is approximately $163,799. For Option 2, the estimated capital cost is approximately $4,081,193, and the estimated O&M cost is approximately $163,799. Detailed cost estimates are in Appendix O.

11.1.1.5.1 Option B - Offsite Disposal

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would eliminate risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) eliminating the migration of contaminants to groundwater and surface water. The threat of direct human exposure to contaminated waste and physical hazards would be eliminated by this alternative. Treatment and removal of the waste material would eliminate contaminant exposure through the receptor routes of ingestion and inhalation. Contaminated soil and slag would be treated and converted to a nonhazardous material and transported to an off-site disposal facility. Structures throughout the site would be demolished and either disposed of in an excavated disposal area beneath the existing pavement or recycled. As a result, physical hazards associated with deteriorating structures would be eliminated. Removal of waste would mitigate contaminant migration from the site.

Compliance with ARARs

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. If remedial equipment is used on site, such as a pugmill mixer or crusher, dust and vapors generated from the use of this equipment will be contained and treated before being discharged to the atmosphere, if required. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Treatment and removal of the waste material would not require monitoring, inspection, or maintenance for the site. Treatment reagents are typically tested by MEP SW-846 Method 1320 to measure long-term stability. The test is intended to approximate leachability under acidic conditions over a 1,000-year time frame. Based on successful completion of bench-scale testing that would include MEP analysis, this alternative is expected to provide adequate long-term effectiveness and permanence. Access restrictions such as land use controls and fencing would likely not be required.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant toxicity and mobility through treatment; contaminant volume would not be physically reduced. Contaminant toxicity would be reduced by altering the physical or chemical structure of the contaminant into a nonhazardous material. Contaminant mobility would be reduced by binding or bonding the contaminant into a nonleachable form. Subsequent removal would mitigate contaminant migration from the site. Contaminant volume would not be physically reduced under this alternative.

Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative meets EPA's expectation to use treatment to address the principal threats posed by a site by treating all the contaminated soil, sediment, and slag. However, treatment of what would be considered low-level threat waste does not meet EPA's expectation to use containment to address such waste, although in some situations, treatment rather than containment of low-level threats is warranted (EPA 1991).

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation, consolidation and treatment of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the decontamination and demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Monitoring of dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Treatment of contaminated soil and slag is offered by numerous vendors. On-site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of waste soil and slag material; however, a slight volume reduction may occur if a chemical reagent is used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment methodology used. An increase in the volume of the treated waste material will have an impact on the transportation costs to a disposal facility. Calculations used in the development of this alternative assume a volume increase of 20 percent.

Wastewater may be generated during implementation of this alternative through water runoff generated as a result of dust emission control. Wastewater may also be generated as a result of decontamination activities required for both equipment and on-site workers. Containment and treatment or disposal of these wastewaters may be required. Depending upon the treatment methodology selected, the wastewater may be able to be utilized in the soils treatment process.

No state or federal permits are expected to be required; however, advance consultation should occur in planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 5B is approximately $7,477,199 for Option 1, which includes the excavated wetlands sediment, and $6,181,160 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $7,313,400, and the estimated O&M cost is approximately $163,799. For Option 2, the estimated capital cost is approximately $6,017,361, and the estimated O&M cost is approximately $163,799. Detailed cost estimates are in Appendix O.

11.1.1.6 Alternative 6 -- Capping With Excavation and Onsite Treatment of Principal-Threat Waste

11.1.1.6.1 Option A - Onsite Disposal of Treated Principal-Threat Waste

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative 2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain

- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,

- the landfill will not cause or contribute to significant degradation of wetlands,

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected, and required maintenance could be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would meet EPA's expectation to use treatment to address the principal threats posed by a site, as well as EPA's expectation to use containment to address low-level threats posed by a site. Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping treated and low level-threat material in a floodplain, no significant construction issues are expected to be encountered.

Treatment of contaminated soil and slag is offered by numerous vendors. On-site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 5 percent.

The on-site disposal area for the treated waste may be classified as a Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities would apply to the site.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 6A is approximately $3,175,137 for Option 1, which includes the excavated wetlands sediment, and $2,729,543 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $3,015,241, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $2,569,647, and the estimated O&M cost is approximately $159,895. Detailed cost estimates are in Appendix O.

11.1.1.6.2 Option B - Offsite Disposal of Treated Principal-Threat Waste

Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative 2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of low level-threat waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

! Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,
- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,
- the landfill will not cause or contribute to significant degradation of wetlands,
- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and
- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected, and required maintenance could be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would meet EPA's expectation to use treatment to address the principal threats posed by a site, as well as EPA's expectation to use containment to address low-level threats posed by a site. Based on sample results collected during previous site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping low level-threat material in a floodplain, no significant construction issues are expected to be encountered.

Treatment of contaminated soil and slag is offered by numerous vendors. On-site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 5 percent.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 6B is approximately $4,936,044 for Option 1, which includes the excavated wetlands sediment, and $4,013,508 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $4,776,149, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $3,853,613 and the estimated O&M cost is approximately $159,895. Detailed cost estimates are in Appendix O.

11.1.2 ANALYSIS OF WETLAND SEDIMENT ALTERNATIVES

11.1.2.1 Alternative 1 -- No Action

Overall Protection of Human Health and the Environment

The no action alternative does not eliminate any exposure pathways or reduce the level of risk of the existing wetland sediment contamination.

Compliance with ARARs

This alternative does not achieve the RAOs or chemical-specific ARARs established for wetland sediment. Location- and action-specific ARARs do not apply to this alternative since further remedial actions will not be conducted.

Long-Term Effectiveness and Permanence

The remediation goals derived for protection of ecological receptors would not be met. Because contaminated wetland sediment remains under this alternative, a review/reassessment of the conditions at the site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

Reduction of M/T/V Through Treatment

No reductions in contaminants M/T/V are realized under this alternative.

Short-Term Effectiveness

Since no further remedial action would be implemented at this site, this alternative poses no short-term risks to onsite workers. It is assumed that Level D personnel protection would be used when sampling various media.

Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

11.1.2.2 Alternative 2 -- Capping With Clean Fill and Off-site Creation of Wetlands

Overall Protection of Human Health and the Environment

This alternative will not remove or contain the contaminated sediments but potentially limits multiple exposure pathways to ecological receptors. Organisms utilizing portions of the wetlands below the surface may potentially continue to be exposed. The volume and concentration in the wetland will not be altered. Lead and other metals in the wetland sediment may continue to result in adverse impacts. of contaminants to surface water.

Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. In addition, the off-site creation of wetlands component of this alternative to compensate for the loss of forested and scrub/shrub wetlands is expected to meet the wetlands mitigation requirements of CWA Section 404. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted,
- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking

of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species,

- the landfill will not cause or contribute to significant degradation of wetlands,
- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function), and
- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented in order to maintain effectiveness.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses incompatible with the site; specifically, land uses that would compromise the cap should be precluded.

The remedial action objectives of reduction of exposure and prevention of transport and migration of site contaminants, and prevention of degradation of adjacent wetlands will be achieved. However, the restoration of wetland communities and elimination of further degradation of the site wetlands will not be achieved.

Reduction of M/T/V Through Treatment

This alternative will not remove or dispose of the contamination. Contaminated sediment will be left intact but the pathway of exposure will be reduced for multiple receptors. Toxicity may be reduced by limiting bioavailability. The volume of material at the site will not be altered.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous site investigations, 8,700 CY of sediment would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and site conditions does not suggest that these situations would apply to the RM site.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal.

On-site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures.

The wetland system would be destroyed since application of the cap will alter grade and hydrology. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Implementability

Construction of a soil cap is a standard construction practice and materials are readily available. Other than the capping of contaminated material in a floodplain and wetland, no significant construction issues are expected to be encountered.

ACOE permits are expected to be required. Advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

The total present worth for Alternative 2 is approximately $611,762. The estimated capital cost is approximately $541,601, and the estimated O&M cost is approximately $70,161. Detailed cost estimates are in Appendix O.

11.1.2.3 <u>Alternative 3 -- Excavation and Revegetation/Restoration of Wetlands</u>

11.1.2.3.1 Option A - Regrading With Clean Fill

Overall Protection of Human Health and the Environment

Source control of surface runoff and sediment transport will effectively eliminate a source of loading of contaminants to the adjacent wetlands. The removal of the contamination from the site wetlands will effectively protect the environment. Removal will also reduce risk to ecological receptors.

The RAOs for reduction of risk to ecological receptors will be met and the alternative will restore the degraded wetlands' structure and function.

Compliance with ARARs

EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. The wetlands revegetation component of this alternative includes a 2-to-1 creation-to-loss ratio to compensate for the loss of forested and scrub/shrub wetlands which is expected to meet the wetlands mitigation requirements of CWA Section 404.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

This alternative provides source control and removal of contaminated sediments in the wetlands. This action would permanently remove contaminated sediments and thereby reduce risk to ecological receptors and improve water quality. The revegetation plan will restore the wetlands to a high functioning value which should support diverse ecological communities.

Reduction of M/T/V Through Treatment

Mobility, toxicity, and volume of contaminants will be reduced through removal, not through treatment.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation; however, these potential, short-term impacts would be mitigated during the wetlands restoration phase. The revegetation plan uses plant species which should restore the system within one growing season, thereby limiting the impacts. Controls can be implemented to reduce impacts on adjacent wetlands.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Short-term impact on biological communities in the wetlands caused by excavation will be notable because of excavation of wetlands sediment. However, the goal of the wetland mitigation program is to replace lost wetland vegetation so that wetland function and values either will be present immediately following the completion of mitigation or will develop over time. In addition, a consideration of breeding seasons, and control of erosion and sedimentation in terms of scheduling activities should ease short-term impact.

Implementability

All services and materials for this alternative are readily available. Moderate difficulty is posed by conducting operations in unstable sediment substrate. To avoid problems, excavation can be limited to dry periods. Revegetation will be performed in the spring and will require one month for completion.

Cost

The total present worth cost for Alternative 3, Option A is approximately $780,071. The estimated capital cost is $700,901. The estimated annual O&M cost is approximately $79,170. Detailed cost estimates are presented in Appendix O.

11.1.1.6.2 Option B - Regrading With Biosolid Compost Material

Overall Protection of Human Health and the Environment

Source control of surface runoff and sediment transport will effectively eliminate a source of loading of contaminants to the adjacent wetlands. The removal of the contamination from the site wetlands will effectively protect the environment. Removal will also reduce risk to ecological receptors.

The RAOs for reduction of risk to ecological receptors will be met and the alternative will restore the degraded wetlands' structure and function.

Compliance with ARARs

EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. The wetlands revegetation component of this alternative includes a 2-to-1 creation-to-loss ratio to compensate for the loss of forested and scrub/shrub wetlands which is expected to meet the wetlands mitigation requirements of CWA Section 404.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

Long-Term Effectiveness and Permanence

This alternative provides source control and removal of contaminated sediments in the wetlands. This action would permanently remove contaminated sediments and thereby reduce risk to ecological receptors and improve water quality. The revegetation plan will restore the wetlands to a high functioning value which should support diverse ecological communities.

Reduction of M/T/V Through Treatment

Mobility, toxicity, and volume of contaminants will be reduced through removal, not through treatment.

Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation; however, these potential, short-term impacts would be mitigated during the wetlands restoration phase. The revegetation plan uses plant species which should restore the system within one growing season, thereby limiting the impacts. Controls can be implemented to reduce impacts on adjacent wetlands.

On-site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Short-term impact on biological communities in the wetlands caused by excavation will be notable because of excavation of wetlands sediment. However, the goal of the wetland mitigation program is to replace lost wetland vegetation so that wetland function and values either will be present immediately following the completion of mitigation or will develop over time. In addition, a consideration of breeding seasons, and control of erosion and sedimentation in terms of scheduling activities should ease short-term impact.

Implementability

The use of biosolid compost material to address metals contamination is an emerging technology with limited full scale application. However, all services and materials for this alternative should be readily available.

Cost

The total present worth cost for Alternative 3, Option B is approximately $699,548. The estimated capital cost is $620,379. The estimated annual O&M cost is approximately $79,170. Detailed cost estimates are presented in Appendix O.

11.1.3 ANALYSIS OF GROUNDWATER ALTERNATIVES

11.1.3.1 <u>Alternative 1 -- No Action</u>

Overall Protection of Human Health and the Environment

The no action alternative does not eliminate any exposure pathways or reduce the level of risk of the existing groundwater contamination.

Compliance with ARARs

This alternative does not achieve the RAOs or chemical-specific ARARs established for groundwater. Location- and action-specific ARARs do not apply to this alternative since further remedial actions will not be conducted.

Long-Term Effectiveness and Permanence

The continued exposure of groundwater to onsite receptors and surface water is a potential long-term impact of this alternative. The remediation goals derived for protection of human health and the environment would not be met. Because contaminated groundwater remains under this alternative, a review/reassessment of the conditions at the site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

Reduction of M/T/V Through Treatment

No reductions of contaminant M/T/V are realized under this alternative.

Short-Term Effectiveness

Since on further remedial actions would be implemented at the site, this alternative poses no short-term risks to onsite workers. It is assumed that Level D personal protection would be used when sampling the various media.

Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

Cost

The total present worth cost for this alternative is approximately $86,597. There are no capital costs are associated with this alternative. Detailed cost estimates are presented in Appendix O.

11.1.3.2 Alternative 2 -- Limited Action

Overall Protection of Human Health and the Environment

Unless the contingency treatment component is implemented, the limited action alternative does not eliminate any exposure pathways and only minimally reduces the level of risk through restrictions designed to prevent access and exposure to groundwater by limiting the type of activities that can take place at the site.

Compliance with ARARs

Unless the contingency treatment component is implemented, this alternative does not achieve the RAOs or chemical-specific ARARs established for groundwater. Location- and action-specific ARARs would not apply to this alternative since further remedial actions will not be conducted (unless the contingency treatment component is implemented.)

Long-Term Effectiveness and Permanence

The continued exposure of groundwater to onsite receptors and surface water is a potential long-term impact of this alternative. Unless the contingency treatment component of this alternative is implemented, the remediation goals derived for protection of human health and the environment would not be met. Because contaminated groundwater remains under this alternative, a review/reassessment of the conditions at the site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

Reduction of M/T/V Through Treatment

No reductions of contaminant M/T/V are realized under this alternative.

Short-Term Effectiveness

Since no further remedial actions would be implemented at the site (i.e. the contingency treatment is not implemented), this alternative poses no short-term risks to onsite workers. It is assumed that Level D personal protection would be used when sampling the various media.

Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

Cost

The total present worth cost for this alternative is approximately $498,095. Capital cost associated with this alternative is $130,295 and O&M costs are $367,800. Detailed cost estimates are presented in Appendix O.

11.1.3.3 Alternative 3A/B/C/D -- Pump & Treat with Physical and/or Chemical Treatment

Overall Protection of Human Health and the Environment

Treatment of contaminated groundwater virtually eliminates all risks associated with the exposure pathways. Extraction of contaminated groundwater would block contaminated groundwater from moving into the wetlands and thus discharging into the surface water downgradient of the site. Treatability studies would ensure that the selected treatment system could remediate groundwater contaminant concentrations to meet remediation goals.

Compliance with ARARs

Implementation of this alternative would meet chemical-specific ARARs by reducing contaminant concentrations to levels below federal MCLs and lead concentrations below the EPA action level.

No conflicts with location-specific ARARs are expected for the implementation of this alternative.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to activities, such as trenching, associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to trenching areas, if as necessary.

Long-Term Effectiveness and Permanence

The pump-and-treat system will have to be maintained to ensure that it continues to perform as designed; consequently, monitoring, inspection, and maintenance would be required. The system may be susceptible to fouling, clogging, or other mechanical failure, and it may also require periodic disposal of sludge generated during treatment. However, the system would be inspected on a regular schedule, and required maintenance could be implemented.

Monitoring would be required until all groundwater monitoring points indicate that contaminant concentrations are below action levels or MCLs.

Pump-and-treat, in conjunction with source control activities, is a long-term solution because it would permanently reduce contaminant concentrations in groundwater. Using precipitation/flocculation/coagulation and sedimentation as a basis, the length of time required to achieve remediation would range from 4 to 11 years, depending on the pumping scenario selected.

Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant volume by removing contaminated groundwater from the site. Removal would also eliminate migration of contaminated groundwater from the site.

Short-Term Effectiveness

The construction phase of this alternative would most likely be accomplished within 2 to 8 weeks, depending on the scenario selected. However, implementation of the preferred removal action alternative for contaminated solid media would be required before installing the pump-and-treat system. A groundwater treatability study may be needed before installing the pump-and-treat system, delaying selection of this alternative.

On-site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during drilling and trenching. Dust emissions would be monitored at the property boundaries. Control of fugitive dust emissions would be provided by applying water as needed to surfaces receiving heavy vehicular traffic or in trenching areas.

Implementability

The technical feasibility of this alternative would have to be evaluated in a treatability study if this alternative is preferred. The study would be required to design an appropriate treatment system.

Construction of the pump-and-treat system uses standard construction practices and equipment. No significant construction issues are expected to be encountered.

The technical feasibility of this alternative also depends on the removal action alternative selected for contaminated solid media. A sitewide disposal area, as proposed in Soil Alternatives 2, 3, 4, and 6a, may preclude the use or require modification of the pump-and-treat system as proposed in this alternative.

Wastewater may be generated during implementation of this alternative through water runoff generated as a result of dust emission control. Wastewater may also be generated as a result of decontamination activities required for equipment and on-site workers. Containment and treatment or disposal of these wastewaters may be required.

No state or federal permits are expected to be required; however, advance consultation should occur in planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

Cost

Using precipitation/flocculation/coagulation and sedimentation treatment as a basis, the total present worth for Alternative 3A is approximately $1,359,116. The estimated capital cost is approximately $349,559 and the estimated O&M cost is approximately $1,009,557.
Detailed cost estimates are in Appendix O.

The total present worth for Alternative 3B is approximately $1,185,719. The estimated capital cost is approximately $355,879 and the estimated O&M cost is approximately $829,900.
Detailed cost estimates are in Appendix O.

The total present worth for Alternative 3C is approximately $867,484. The estimated capital cost is approximately $362,078 and the estimated O&M cost is approximately $505,406. Detailed cost estimates are in Appendix O.

The total present worth for Alternative 3D is approximately $1,652,450. The estimated capital cost is approximately $440,397 and the estimated O&M cost is approximately $1,212,053. Detailed cost estimates are in Appendix O.

Table 2-8 Process Area: Exposure to Lead

Table 2-9 Process Area: Exposure to Lead (w/o Groundwater Pathway)

Table 2-10 Landfill: Future Risk Summary

Table 2-11 Landfill: Future Risk Summary (w/o Groundwater Pathway)

Landfill: Exposure to Lead

Lead was detected in all Landfill Area soil samples at concentration ranging from 35 - 42,400 ppm; the average concentration was 5,964 ppm. Lead was also detected in Site groundwater at concentrations of 3 to 1,600 µg/l; the average concentration was 196 µg/l. These values were input into version 0.99d of the IEUBK model. The results are summarized in **Table 2-12**. Also, a default value of 4 ug/l for groundwater was input into the model. The results are summarized in **Table 2-13**. EPA uses a level of 10 µg lead per deciliter (dl) blood as the benchmark to evaluate lead exposure. As can be seen, the projected blood lead levels exceeded this threshold for all age groups, indicating that lead concentrations are above the acceptable range.

Wetland/Woodland Area

Future development in the Wetland/Woodland Area is unlikely due to its location in a 100-Year Floodplain and wetlands. Therefore, the only receptors that may come into contact with contaminants are Site visitors. Exposure routes potentially complete are:

- inadvertent ingestion of soil,
- dermal contact with soil,
- inhalation of dust, and
- inadvertent ingestion of surface water

Wetland/Woodland Area: Exposure to Lead

Due to the intermittent exposure to lead in the Wetland/Woodland Area, the IEUBK model cannot be directly used to estimate blood lead levels. However, if a child were to visit this area as little as once per week (the same exposure frequency assumed for the Site visitor), the child would establish

Table 2-12 Landfill: Exposure to Lead

Table 2-13 Landfill: Exposure to Lead (w/o Groundwater Pathway) a steady state blood lead level, and the risk to this child would be over EPA's acceptable level. This is because the lead concentration in the Wetland/Woodland Area (average concentration 4,555 mg/kg) is more than seven times the IEUBK-based residential remedial level for lead (400 mg/kg).

2.6.2 Ecological Risk Assessment Summary

An ecological risk assessment was conducted to determine the potential for ecological risk at the Site. This section summarizes the approach that was followed and the conclusions that were drawn.

The risk assessment was designed to evaluate the potential threats to ecological function from exposure to Site contaminants and to establish Site-specific clean-up levels for the contaminants of concern (COCs). The problem formulation process included the identification of COPCs, the identification of exposure pathways, a determination of the assessment endpoints for the Site, the formulation of testable hypotheses, the development of a conceptual model, and the determination of the measurement endpoints.

2.6.2.1 Identification of Chemicals of Concern

A screening-level risk assessment was conducted in which the maximum concentrations of contaminants detected in the surface water and sediment at the Site were compared to various benchmark values in order to identify chemical of potential concern (COPCs). Metals had previously been identified as contaminants at the Site, based on knowledge of the industrial history of the facility, as well as the results from a variety of United States Environmental Protection Agency (U.S. EPA) sampling investigations. The metals and organics data were screened using a risk characterization process that relates exposure concentrations to concentrations that potentially cause adverse effects. The exposure concentrations were the highest concentration detected for each contaminant in the sediment and surface water samples collected on Site (not including the reference samples). The benchmark concentrations used in the screening-level risk assessment were the U.S. EPA Region 4 Waste Management Divison Screening Values for Hazardous Waste Sites. If a Region 4 screening value was not available for a particular contaminant, the U.S. EPA Region 3 Screening Level, if available, was used (U.S. EPA 1995).

An elevated hazard quotient (greater than one) resulting from the screening-level risk assessment indicates that exposure to the contaminant may cause an adverse effect. However, more assessment is needed to determine if the contaminants exceeding the benchmark values pose a risk to ecological receptors at the Site. The contaminants for which maximum concentrations of compounds exceeded benchmarks for water and/or sediment at the Ross Metals Superfund Site are summarized next and in **Table 2-14**.

Many inorganic compounds exceeded the benchmark values for surface water and/or sediment. The maximum surface water concentrations recorded at the Site exceeded the benchmark values for the following compounds: aluminum, antimony, cadmium, copper, iron, lead, thallium and zinc. The maximum sediment concentrations recorded at the Site exceeded the benchmark values for the following compounds: antimony, arsenic, cadmium, copper, lead, mercury, nickel, silver, and zinc. In addition, twelve inorganic compounds for which no sediment benchmark exists were detected in sediment. These compounds are aluminum, barium, beryllium, calcium, cobalt, iron, magnesium, potassium, selenium, sodium, thallium, and vanadium (Table 2-14).

The listing of COPC was further refined by conducting a Site-specific ecological risk assessment.

Table 2-14 COCs Distribution and Hazard Quotient Calculations										
Contaminant	Maximum Concentrations in Sediment					Maximum Concentrations in Water (Filtered)				
	Maximum Sediment Concentration	Detections/Samples	Screening Value	Reference Source	HQ	Maximum Water Concentration	Detections/Samples	Screening Value	Reference Source	HQ
Metals	mg/kg (dry weight)					ug/l				
Aluminum	17,800	21/21	NB	NB	NB	506	5/5	87	d	6
Antimony	1,350	18/21	12	d	113	31.1	5/5	160	d	0.19
Arsenic	681	21/21	7.24	d	94	165	4/5	190	d	0.9
Cadmium	99.1	14/21	1	d	99	5.9	2/5	0.66	d	9
Copper	712	21/21	18.7	d	38	226	5/5	6.54	d	35
Iron	32,300	21/21	NB	NB	NB	17,600	5/5	1,000	d	18
Lead	98,100	21/21	30.2	d	3,248	924	5/5	1.32	d	700
Mercury	1.1	4/21	0.13	d	8	U	0/5	0.012	d	0
Nickel	127	21/21	15.9	d	8	34	4/5	87.81	d	0.4
Silver	2.1	2/21	0.733	d	3	U	0/5	0.012	d	0
Thallium	5.5	1/21	NB	NB	NB	18	2/5	4	d	45
Zinc	629	21/21	124	d	5	783	5/5	58.91	d	13

2.6.2.2 Ecological Exposure Assessment

Setting

The wetlands delineated on the Site were both naturally formed and human-made. Wetlands on the landfill and within the RM Site boundary are considered human-made. The remaining wetlands identified and delineated are considered natural systems.

Four wetland areas were identified and delineated at the RM Site. Two of the wetland areas were isolated emergent wetlands delineated on the landfill in the northern portion of the RM Site. One isolated emergent wetland was identified in the southwest portion of the RM Site. The areas to the east and north of the RM Site are classified as wetland. This wetland complex included an emergent wetland located in the southeastern portion of the landfill. Wetlands east of the Site consisted of emergent wetlands that were replaced in succession by broad-leaved deciduous scrub/shrub and broad-leaved deciduous forested wetlands as you proceeded north and east. Wetlands north of the Site consisted of broad-leaved deciduous forested wetlands. Needle-leaved deciduous (baldcypress) forested wetlands replaced the broad-leaved deciduous forested wetlands as you proceeded north and northeast from the study area. These wetlands are part of a large wetland complex associated with the Wolf River floodplain.

Vegetation

Five vegetation types/communities (was one upland community and four wetland) were identified in the investigation area. The classification of wetlands followed Cowardin et al. (1979).

1) Upland field
2) Palustrine emergent (PEM)

3) Palustrine broad-leaved deciduous scrub/shrub (PSS1)

4) Palustrine broad-leaved deciduous forested (PFO1)

5) Palustrine needle-leaved deciduous (baldcypress) forested (PFO2)

Note that the survey was conducted after fall dieback of vegetation. Therefore, the identification of herbaceous species was limited.

Upland field

The southern/southeastern portion of the RM Site contained an area of open field. Common species included *Poa spp*., broomsedge (*Andropogon spp*.) and foxtail (*Setaria spp*.).

Palustrine emergent wetland

Four separate emergent wetland areas were identified at the Site. Three were isolated wetlands. Two of these are located on the landfill. The third isolated wetland is located within the southeastern portion of the RM Site. The fourth emergent wetland is located to the east of the RM facility area and is part of a large wetland complex associated with the Wolf River.

Dominant plant species for these areas included soft rush (*Juncus effusus*), cattail (*Typha spp*.), cutgrass (*Leersya spp.*) and a variety of sedges, grasses and herbaceous species, most of which could not be identified due to the time of the Site visit (following fall dieback of vegetation).

Palustrine broad-leaved deciduous scrub/shrub (PSS1)

This wetland type was found east and northeast of the RM Site, and was a transition between the PEM and forested wetlands within the study area.

Common sapling species include green ash (*Fraxinus pennsylvanica*), willow oak (*Quercus phellos*), sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*) and box elder (*Acer negundo*). Common shrub species included buttonbush (*Cephalanthus occidentalis*) and Rubus species (*Rubus spp*.). Understory species included most of those identified in the PEM wetlands. Other common species included Japanese honeysuckle (*Lonicera japonica*), field garlic (*Allium spp*.) and unidentified grasses and asters.

<u>Palustrine broad-leaved deciduous forested (PFO1)</u>

This wetland type was identified to the north of the landfill and to the east and north of the PSS1 wetlands. Common tree species included sweet gum, willow oak, overcup oak (*Quercus lyrata*), American elm (*Ulmus americana*), river birch (*Betula nigra*), and red maple. Common shrub species included common winterberry (*Ilex verticillata*), and a honeysuckle species (*Lonicera spp*.). The sparse groundcover included numerous seedlings, birdbill spikegrass (*Chasmanthium ornithorhynchum*), sensitive fern (*Onoclea sensibilis*), and nettles. Greenbriars (*Smilax spp*.) were a common woody vine.

<u>Palustrine needle-leaved deciduous (baldcypress) forested (PFO2)</u>

This wetland type was located north of the PFO1 wetlands. Baldcypress (*Taxodium distichum*) was the only tree species in this wetland type. Virginia willow (*Itea virginica*) was the only shrub species found, and was restricted to elevated mounds scattered in the wetland area. Herbaceous species were lacking.

Soils

Soil color was generally a reliable indicator of wetland (hydric) and nonwetland areas at the Site and adjacent areas. Gleying, oxidized root channels, and accumulation of organic matter in the top 12 inches of the soil surface were all positive indicators of hydric soils in wetland areas. The soil profiles suggested alluvial soils. This is consistent with the Fayette County soil survey mapping for the area (Flowers 1964)

Upland soils lacked mottles and hydric color, and were generally a brighter color than hydric soils in wetlands.

Hydrologic Conditions

Direct evidence of wetland hydrologic conditions in the form of standing water, and soil saturation or free water within twelve inches of the soil surface in soil borings, was recorded at the wetland sample stations during Site visits. Emergent wetlands contained standing water and saturation to the soil surface. The scrub/shrub and deciduous forested wetlands generally had saturation and/or free water within 10 inches of the soil surface. The baldcypress wetlands contained standing water.

Indirect indicators of wetland hydrologic conditions included a lack of accumulated litter in forested wetland areas and water stained leaves. This suggests that the area may be flooded by the Wolf River.

Other Waters

Two drainage features were identified within the study area. One of these is a drainage swale (slough) north of the Site that conveys surface water to the north into a baldcypress swamp.

It is associated with an area of emergent wetland. This drainage feature likely receives runoff from the RM Site that gathers in the northeast corner of the Site and from portions of the landfill that slope towards the east and northeast.

The second drainage feature, a ditch located north of the Site, is the remnant of an historic stream that was originally located along the western edge of the Site, and may have been part of the Site. There are no defined channels connecting this ditch with the RM Site.

Another ditch is located east of the Site, just to the east of the boundary of the PFO1 wetland along the eastern edge of the study area. The ditch bends towards the west as it proceeds north, eventually discharging into the baldcypress swamp north of the RM Site. No defined channels from the RM Site discharge into this ditch.

These three drainage features join in the baldcypress swamp north of the RM Site, and eventually discharge into the Wolf River, which is a tributary of the Mississippi River.

<u>Exposure Pathways</u>

Prior to the initiation of the ecological risk assessment, it was known that elevated levels of contaminants were present in the sediment, water, and possibly the biota on and adjacent to the Site. The contamination was not only present within the facility boundaries, but also extended approximately 300 feet east and 200 feet north of the facility boundaries. The degree of contamination further away from the facility was not known prior to conducting this risk assessment. A drainage ditch flows from a stormwater collection sump in the northeast corner of the facility area into the wetland area approximately 380 feet due northeast. This ditch could act as a pathway for contamination to continue migration northeast of the facility, especially during heavy rain events. It was also not know whether the contamination had migrated into the Wolf River, approximately ½-mile north of the facility. Therefore, the wetlands north and east of the facility, the Wolf River, and the facility itself were identified as areas of concern prior to this risk assessment.

Chemical analyses of sediment, water, and biota were used to determine the levels of contaminants in each area. The maximum concentration and the arithmetic mean of each contaminant concentration were calculated from the resulting analytical data and used in the risk assessment to represent the conditions of Site-specific exposure.

On-Site receptors are potentially exposed to contaminants in abiotic matrices through direct contact, intentional ingestion (e.g., consumption of water and food items), and incidental ingestion (e.g., sediment adhered to food items). Transfer of the contaminants to receptors could also occur through processes of bioaccumulation through the food chain, whereby higher trophic level receptors are exposed to Site contaminants through the ingestion of contaminated prey items.

Summary of field studies and modeling : A field investigation was conducted to obtain Site-specific contaminant concentrations in water, sediment, and biological tissue that would provide data necessary for the completion of the Site risk assessment. Surface water and sediment samples were collected along a suspected contamination gradient (based on XRF data) in the adjacent wetlands and submitted for Target Analyte List (TAL) metals analysis. The sediment samples were also submitted for toxicity evaluations. Analytical data from the Wolf River, a water body connected to the wetland system, was collected to assess potential risk to that system. Three locations were identified along the Wolf River, “upstream,” “midstream,” and “downstream,” from which sediment samples were collected and submitted for TAL metals analysis. Site-specific tissue concentrations were also obtained for use in food chain modeling. Plant, grasshopper, and frog samples were collected and submitted for tissue analysis of TAL metals. These Site-specific tissue residue levels were used to predict the amount of contaminant transfer through trophic levels and subsequently, to the ecological functioning of the system.

Solid-phase toxicity evaluations were conducted to determine the effects of direct contact with Site contaminants to aquatic organisms. The underlying premise of these toxicity evaluations was that the organism response can be associated with the contaminant levels determined by the chemical analyses. The endpoints for these evaluations were survival and growth (measured as body length for *H. azteca* and body weight for *C. tentans*). The methods used to conduct these studies are described in the final toxicological evaluation reports. In addition, measured concentrations of each contaminant of concern in surface water were compared to literature-based values on the toxicity to early life stages of amphibians. This provided a qualitative assessment of the risk of the Site contamination to amphibians.

Finally, the results of the analyses of water, sediment, and tissue (food items) were used in a food chain model to predict exposure dosages for each contaminant of concern to upper trophic levels. For the purposes of the model, it was assumed that the food of herbivorous species (meadow vole) comprised 100 percent soft rush, the food of insectivorous species (red-winged blackbird, short-tailed shrew) comprised 100 percent grasshoppers, and the food of carnivorous species (green heron, mink) comprised 100 percent green tree frogs, since these were the food items collected from the Site and analyzed. The resulting exposure dosages were divided by an effect concentration derived from the literature to provide a hazard quotient for each contaminant of concern and each receptor species.

2.6.2.3 Ecological Effects Assessment

A review of the wetland and surrounding habitats provided information for the selection of assessment endpoints. A variety of invertebrates, vertebrates, and plants inhabit the wetland. In addition, many birds and mammals from adjacent habitats could prey on the wetland flora and fauna. Therefore, the assessment endpoints will focus on these biological groups. The assessment endpoints relate specifically to viability of avian, mammalian, and wetland invertebrate, vertebrate and plant populations as well as organism survivability were selected as assessment endpoints for this risk assessment. Listed next and summarized in **Table 2-15** are the specific assessment endpoints selected followed by the supporting measurement endpoint:

Table 2-15
Ecological Exposure Pathways of Concern

Exposure Media	Exposure Routes	Assessment Endpoints	Measurement Endpoints	Receptor	Endangered or Threatened Species
Sediment/Surface Water	Incidental sediment ingestion Direct contact with sediment Accumulation in forage Direct contact with surface water	Protection of benthic invertebrate community structure and function.	Toxicity of sediments to *Chironomus tentans* and *Hyalella azteca*	*Chironomus tentans* and *Hyalella azteca*	No
Sediment/Surface Water	Incidental sediment ingestion Direct contact with sediment Accumulation in forage Direct contact with surface water	Protection of amphibians from adverse effects on growth, survival, and/or reproductive success.	Comparisons with literature-based values on the toxicity of surface water concentrations to early life stages of amphibians	Green tree frog, *Hyla cinerea*	No
Soil/Sediment/Surface Water	Incidental soil/sediment ingestion Direct contact with soil/sediment Accumulation in forage Ingestion of surface water	Protection of insectivorous birds from adverse effects on growth, survival, and/or reproductive success.	Dietary exposure studies were selected to evaluate risk to insectivorous bird species that use the site.	Red-winged blackbird, *Agelaius phoeniceus*	No
Sediment/Surface Water	Incidental soil/sediment ingestion Direct contact with soil/sediment Accumulation in forage Ingestion of surface water	Protection of carnivorous birds from adverse effects on growth, survival, and/or reproductive success.	Dietary exposure studies were selected to evaluate risk to carnivorous bird species that use the site.	Green heron, *Butorides striatus*	No
Soil/Sediment/Surface Water	Incidental soil/sediment ingestion Direct contact with soil/sediment Accumulation in plant forage Ingestion of surface water	Protection of herbivorous mammals from adverse effects on growth, survival, and/or reproductive success.	Dietary exposure studies were selected to evaluate risk to herbivorous mammals that use the site.	Meadow vole, *Microtus pennsylvanicus*	No
Soil/Sediment/Surface Water	Incidental soil/sediment ingestion Direct contact with soil/sediment Accumulation in forage Ingestion of surface water	Protection of insectivorous mammals from adverse effects on growth, survival, and/or reproductive success.	Dietary exposure studies were selected to evaluate risk to insectivorous mammals that use the site.	Short-tailed shrew, *Blarina brevicauda*	No
Soil/Sediment/Surface Water	Incidental soil/sediment ingestion Direct contact with soil/sediment Accumulation in forage Ingestion of surface water	Protection of carnivorous mammals from adverse effects on growth, survival, and/or reproductive success	Dietary exposure studies were selected to evaluate risk to carnivorous mammals that use the site.	Mink, *Mustela vison*	No

- Protection of benthic invertebrate community structure and function.

  Toxicity evaluations using sediment and benthic invertebrate species were conducted to determine if contaminant levels in the sediment have an adverse effect on survival and growth, measured as body weight and body length. The midge, *Chironomus tentans*, and the amphipod, *Hyalella azteca*, were selected to represent benthic invertebrates.

- Protection of amphibians from adverse effects on growth, survival, and/or reproductive success.

  Comparisons with literature-based values on the toxicity of surface water concentrations to early life stages of amphibians were used to evaluate risk to amphibian species that use the Site. The green tree frog, *Hyla cinerea*, was selected to represent an amphibian.

- Protection of insectivorous birds from adverse effects on growth, survival, and/or reproductive success.

  Dietary exposure studies were selected to evaluate risk to insectivorous bird species that use the Site. The red-winged blackbird, *Agelaius phoeniceus*, was selected to represent an insectivorous bird. Appropriate food items were identified and a contaminant dose calculated based on the ingestion of contaminated prey (grasshoppers) and water.

- Protection of carnivorous birds from adverse effects on growth, survival, and/or reproductive success.

Dietary exposure studies were selected to evaluate risk to carnivorous bird species that use the Site. The green heron, *Butorides striatus*, was selected to represent a carnivorous bird. Appropriate food items were identified and a contaminant dose calculated based on the ingestion of contaminated prey (frogs), sediment, and water.

- Protection of herbivorous mammals from adverse effects on growth, survival, and/or reproductive success.

  Dietary exposure studies were selected to evaluate risk to herbivorous mammal species that use the Site. The meadow vole, *Microtus pennsylvanicus*, was selected to represent a herbivorous mammal. Appropriate food items were identified and a contaminant dose calculated based on the ingestion of contaminated food (plants), sediment, and water.

- Protection of insectivorous mammals from adverse effects on growth, survival, and/or reproductive success.

  Dietary exposure studies were selected to evaluate risk to insectivorous mammals that use the Site. The short-tailed shrew, *Blarina brevicauda*, was selected to represent an insectivorous mammal. Appropriate food items were identified and a contaminant dose calculated based on the ingestion of contaminated prey (grasshoppers), sediment, and water.

- Protection of carnivorous mammals from adverse effects on growth, survival, and/or reproductive success.

  Dietary exposure studies were selected to evaluate risk to carnivorous mammals that use the Site. The mink, *Mustela vison*, was selected to represent a carnivorous mammal. Appropriate food items were identified and a contaminant dose calculated based on the ingestion of contaminated prey (frogs), sediment, and water.

Summary of Toxicity Tests: The results of the 10-day sediment toxicity test using the amphipod, *Hyalella azteca,* are summarized in the Ecological Risk Assessment. Survival was significantly reduced in only the treatment for Location 3 (see **Figure 2-21**) when compared to both the laboratory control and Reference 1. There were no significant reductions in growth for any location compared to either Reference 1 or the laboratory control. Therefore, sediment from Location 3 was acutely toxic to *Hyalella*, but no chronic toxicity was detected in any of the locations. The final report for this test can be found in the Ecological Risk Assessment.

The results of the 10-day sediment toxicity test using the midge, *Chironomus tentans,* are summarized in the Ecological Risk Assessment. When compared to the reference, survival was significantly reduced only in the treatments for Location 3. When compared to the laboratory control, survival in the treatments for Locations 2, 3, and 12 were significantly reduced. Since this Risk Assessment is based on comparisons to the reference area, it can be concluded that only the sediment from Location 3 was acutely toxic to *Chironomus tentans.* The final reports for these tests can be found in the Ecological Risk Assessment.

Summary of Food Chain Model Results: The hazard quotient method (Barnthouse et al. 1986; U.S. EPA 1989) was employed to predict the effects of surface water and sediment contamination at the Site with regard to assessment endpoints. The hazard quotient method compares exposure concentrations to ecological endpoints such as reproductive failure or reduced growth. The comparisons are expressed as ratios of potential intake values to population effect levels. In addition, due to the magnitude of the concentrations of lead in sediment and water collected at the Ross Metals Site, an acute hazard quotient was also calculated for lead using an acute toxicity value. The effect level values are based on studies published in the literature. The exposure concentrations were

Figure 2-21 Site and Reference Area Location Map estimated by employing a food chain model for each receptor species. In these food chain models, ingestion rates of each contaminant of concern for each receptor species are determined based on known or estimated water, sediment, and food ingestion rates and body weights of each receptor species, as well as the measured concentrations of each contaminant in water, sediment, and food items collected at the Site. The exposure concentrations and toxicity values are entered into the hazard quotient equation, and a hazard quotient is calculated. If the hazard quotient for a particular contaminant is greater than one based on an acute value, this indicates that there is an acute risk from that contaminant to the ecological receptor in question. If the hazard quotient is greater than one based on a No Observed Adverse Effects Level (NOAEL), this indicates that there is a potential chronic risk from that contaminant to the ecological receptor in question. If the hazard quotient is greater than one based on a Lowest Observed Adverse Effects Level (LOAEL) for a particular contaminant, this indicates a more serious risk in that the Site levels of that contaminant have the potential to produce an actual adverse effect on survival, reproduction, or growth of the ecological receptor in question. The hazard quotient should be interpreted based on the severity of the effect reported.

In addition to determining whether each contaminant poses a risk to the selected assessment endpoints, preliminary ecotoxicologically-based remedial goals were established for those contaminants which were determined to be risks. These remedial goals are for sediment, and they are based on the premise that if the concentration of a contaminant is decreased in sediment, its concentration would subsequently decrease in surface water and biota. The characteristics of the Site were such that the surface water above the sediment was only a few centimeters deep. This would presumably allow for rapid equilibrium of contaminants between the sediment and water at the Site. Using these assumptions, a water:sediment contaminant ratio and a biota:sediment contaminant ratio were calculated for the Site based on mean concentrations of each contaminant at the Site. The sump area was excluded from the sediment denominator in the water:sediment and plant:sediment ratios, because no water or plant samples were collected from the sump area. The ratios were applied to the food chain model described previously, and the sediment concentration in the model was changed, thus changing the water and biota concentrations according to the calculated ratios until the hazard quotient was just less than one. This calculation was performed for both the NOAEL and LOAEL values, thus providing a preliminary ecotoxicologically based remedial goal for each contaminant presenting a risk and for each assessment endpoint.

Results and Conclusions of the Acute Risk Characterization for Lead

The food chain model and acute hazard quotient calculations for lead and the five assessment endpoints evaluated using this model are presented in the Ecological Risk Assessment. Using the mean and maximum lead concentrations in sediment, no acute risk from lead to insectivorous birds, carnivorous birds, or carnivorous mammals was calculated. However, for insectivorous mammals, both the mean and maximum lead concentrations in sediment calculated an acute risk from lead. In addition, an acute risk to herbivorous mammals was calculated when the maximum lead concentration in sediment was used, but not when the mean concentration was used. These results indicate that an acute risk is posed to herbivorous and insectivorous mammals from the lead contamination at the Ross Metals Superfund Site.

When the sediment concentration of lead was adjusted so that the acute hazard quotient was just less than one, as described previously, a lead concentration of 9310 mg/kg in sediment was calculated for herbivorous mammals and 2160 mg/kg for insectivorous mammals. Therefore, a lead concentration of less than 2160 mg/kg in sediment at the Ross Metals Superfund Site is expected to be protective of an acute threat to the avian and mammalian receptors evaluated in this risk assessment.

Results and Conclusions of the Chronic Risk Characterization for Insectivorous Birds

The food chain model and chronic hazard quotient calculations for insectivorous birds are presented in the Ecological Risk Assessment. Using the maximum concentrations for each contaminant of concern and the NOAEL, it was determined that a potential risk is associated with lead at the Ross

Metals Superfund Site. Additionally, the mean contaminant concentrations and the NOAEL also calculated a potential risk from lead at the Site. When the maximum contaminant concentrations and the LOAEL were used in the model, a risk was still calculated from lead. However, when the mean contaminant concentrations and the LOAEL were used in the model, no risk was calculated from any contaminant.

When the sediment concentration of lead was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 933 mg/kg and a LOAEL of 9330 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based target remedial goal of 933 mg/kg - 9330 mg/kg for lead in sediment was determined for the protection of insectivorous birds.

<u>Results and Conclusions of the Chronic Risk Characterization for Carnivorous Birds</u>

The food chain model and chronic hazard quotient calculations for carnivorous birds are presented in the Ecological Risk Assessment. Using the maximum concentrations for each contaminant of concern and the NOAEL, it was determined that lead poses a potential risk at the Ross Metals Superfund Site. The mean contaminant concentrations and the NOAEL also calculated a potential risk from lead at the Site. When both the maximum and the mean contaminant concentrations were used with the LOAEL in the model, a risk was still calculated from lead.

When the sediment concentration of lead was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 133 mg/kg and a LOAEL of 1330 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 133 mg/kg - 1330 mg/kg for lead in sediment was determined for the protection of carnivorous birds.

<u>Results and Conclusions of the Chronic Risk Characterization for Herbivorous Mammals</u>

The food chain model and chronic hazard quotient calculations for herbivorous mammals are presented in the Ecological Risk Assessment. Using the maximum concentrations for each contaminant of concern and the NOAEL, it was determined that aluminum, arsenic, cadmium, lead, and nickel pose a potential risk at the Ross Metals Superfund Site. When the mean contaminant concentrations and the NOAEL were used in the model, no risk from nickel was calculated, but a potential risk was still calculated from aluminum, arsenic, cadmium, and lead. When the maximum contaminant concentrations and the LOAEL were used in the model, a risk was still calculated from aluminum, arsenic, cadmium, and lead. When the mean contaminant concentrations and the LOAEL were used in the model, no risk was calculated from arsenic or cadmium, but a risk was still evident from aluminum and lead.

When the sediment concentration of aluminum was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 123 mg/kg and a LOAEL of 1230 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 123 mg/kg - 1230 mg/kg for aluminum in sediment was determined for the protection of herbivorous mammals.

When the sediment concentration of arsenic was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 0.16 mg/kg and a LOAEL of 1.6 mg/kg in sediment were established. Therefore, a preliminary ecotoxicologically-based remedial goal of 0.16 mg/kg - 1.6 mg/kg for arsenic in sediment was determined for the protection of herbivorous mammals.

When the sediment concentration of cadmium was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 0.25 mg/kg and a LOAEL of 2.5 mg/kg in sediment were established. Therefore, a preliminary ecotoxicologically-based remedial goal of 0.25 mg/kg - 2.5 mg/kg for cadmium in sediment was determined for the protection of herbivorous mammals.

When the sediment concentration of lead was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 556 mg/kg and a LOAEL of 5560 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 556 mg/kg - 5560 mg/kg for lead in sediment was determined for the protection of herbivorous mammals.

When the sediment concentration of nickel was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 1.5 mg/kg in sediment was established. A LOAEL for nickel in sediment was not determined because when the mean and maximum nickel concentrations and a LOAEL were used in the original model, no risk was established. Therefore, the preliminary ecotoxicologically-based remedial goal is an unbounded NOAEL of 1.5 mg/kg of nickel in sediment for the protection of herbivorous mammals.

Results and Conclusions of the Chronic Risk Characterization for Insectivorous Mammals

The food chain model and chronic hazard quotient calculations for insectivorous mammals are presented in the Ecological Risk Assessment. Using the maximum concentrations for each contaminant of concern and the NOAEL, it was determined that aluminum, arsenic, cadmium, lead, and nickel pose a potential risk at the Ross Metals Superfund Site. When the mean contaminant concentrations and the NOAEL were used in the model, no risk from cadmium or nickel was calculated, but a potential risk from aluminum, arsenic, and lead was still evident. When both the mean and maximum contaminant concentrations and the LOAEL were used in the model, a risk was still evident from aluminum, arsenic, and lead.

When the sediment concentration of aluminum was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 53.3 mg/kg and a LOAEL of 533 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 53.3 mg/kg - 533 mg/kg for aluminum in sediment was determined for the protection of insectivorous mammals.

When the sediment concentration of arsenic was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 0.14 mg/kg and a LOAEL of 1.4 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 0.14 mg/kg - 1.4

mg/kg for arsenic in sediment was determined for the protection of insectivorous mammals.

When the sediment concentration of cadmium was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 0.46 mg/kg in sediment was established. A LOAEL for cadmium in sediment was not determined because when both the mean and maximum cadmium concentrations and a LOAEL were used in the original model, no risk was established. Therefore, the preliminary ecotoxicologically-based remedial goal is an unbounded NOAEL of 0.46 mg/kg of cadmium in sediment for the protection of insectivorous mammals.

When the sediment concentration of lead was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 129 mg/kg and a LOAEL of 1290 mg/kg were determined. Therefore, a preliminary ecotoxicologically-based remedial goal of 129 mg/kg - 1290 mg/kg for lead in sediment was determined for the protection of insectivorous mammals.

When the sediment concentration of nickel was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 1.40 mg/kg in sediment was established. A LOAEL for nickel in sediment was not determined because when the mean and maximum nickel concentrations and a LOAEL were used in the original model, no risk was established. Therefore, the preliminary ecotoxicologically-based remedial goal is an unbounded NOAEL of 1.40 mg/kg of nickel in sediment for the protection of insectivorous mammals.

Results and Conclusions of the Chronic Risk Characterization for Carnivorous Mammals

The food chain model and chronic hazard quotient calculations for carnivorous mammals are presented in the Ecological Risk Assessment. Using the maximum concentrations for each contaminant of concern and the NOAEL, it was determined that aluminum, arsenic, and lead pose a potential risk at the Ross Metals Superfund Site. When the mean contaminant concentrations and the NOAEL were used in the model, a potential risk was still calculated from aluminum, arsenic, and lead. When the maximum contaminant concentrations and the LOAEL were used in the model, a risk was still calculated from arsenic and lead. When the mean and LOAEL were used, no risk to carnivorous mammals was evident from any of the contaminants.

When the sediment concentration of aluminum was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 321 mg/kg in sediment was established. A LOAEL for aluminum in sediment was not determined because when the mean and maximum aluminum concentrations and a LOAEL were used in the original model, no risk was established. Therefore, the preliminary ecotoxicologically-based remedial goal is an unbounded NOAEL of 321 mg/kg of aluminum in sediment for the protection of carnivorous mammals.

When the sediment concentration of arsenic was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 0.31 mg/kg and a LOAEL of 3.1 mg/kg in sediment were established. Therefore, the preliminary ecotoxicologically-based remedial goal of 0.31 - 3.1 mg/kg of arsenic in sediment was determined for the protection of carnivorous mammals.

When the sediment concentration of lead was adjusted so that the hazard quotient was just less than one, as described previously, a NOAEL of 4490 mg/kg and a LOAEL of 44,900 mg/kg in sediment were established. Therefore, the preliminary ecotoxicologically-based remedial goal for lead in sediment is 4490 - 44,900 mg/kg for the protection of carnivorous mammals.

2.6.2.4 Conclusions

The results of the analyses of the samples collected at the Site indicated that it has been heavily contaminated with metals. Contamination extends both north and east of the Site and into the adjacent wetlands. Of all the metals calculated to pose a potential risk, lead was determined to pose the highest risk to ecological receptors. It was also determined that organic contaminants are present at the Site; however, the magnitude and extent of this contamination remains uncertain because of the small sample size. Site-related contaminants have not been detected in the Wolf River.

The following sections present the conclusions that were drawn regarding the viability of avian, mammalian, and wetland invertebrate, vertebrate and plant populations, as well as organism survivability. NOAEL and LOAEL ranges for each receptor group are presented in **Table 2-16**.

2.7 REMEDIATION OBJECTIVES

2.7.1 Remedial Goals

For the protection of human health and ecological receptors, those COCs that are related to past operations at the facility have been considered in the development of a soil/sediment remedial alternative. These COCs include aluminum, antimony, arsenic, barium, cadmium, copper, iron, lead, manganese, selenium, and vanadium. For ecological receptors, COCs include aluminum, antimony, arsenic, cadmium, copper, iron, lead, mercury, nickel and zinc.

Development of a remedial effort specifically for contaminated surface water is not recommended if the contaminant source is remediated. That is, if contaminated sediments are removed, surface water would be remediated. Surface water quality could be monitored to determine the effectiveness of the contaminant source remediation.

The geochemical model mention previously in Section 2.5.7.4 indicated that removal of lead to 100 ppm left a residual soil lead concentration of 31.71 ppm, which is near background levels. It predicts that removal of 100ppm would be protective or groundwater for at least 90 years. However, the conservative nature of this number, along with the uncertainty surrounding the modeling effort, make it inappropriate to use as a subsurface soil cleanup goal.

The 100 ppm goal is based on the assumption of a 5,000 ppm surface load factor. However, the

Table 2-16
COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors

Habitat Type	Exposure Medium	COC	Protective Level Range	Units	Basis	Assessment Endpoint
Wetland/Creek	Sediment	Antimony Arsenic Cadmium Copper Lead Mercury	19-70 10-45 3.2-3.3 15-68 2,790-13,098 <0.14	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of benthic invertebrate community structure and function.
Wetland/Soils	Soil/Sediment	Lead	933-9330	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of insectivorous birds from adverse effects on growth, survival, and/or reproductive success.
Wetlands/Soils	Soil/Sediment	Lead	133-1330	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of carnivorous birds from adverse effects on growth, survival, and/or reproductive success.
Wetlands/Soils	Soil/Sediment	Aluminum Arsenic Cadmium Lead Nickel	123-1230 0.16-1.6 0.25-2.5 556-5560 >1.5	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of herbivorous mammals from adverse effects on growth, survival, and/or reproductive success.
Wetlands/Soils	Soil/Sediment	Aluminum Arsenic Cadmium Lead Nickel	53.3-533 0.14-1.4 >0.46 129-1290 >1.4	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of insectivorous mammals from adverse effects on growth, survival, and/or reproductive success.
Wetlands/Soils	Soil/Sediment	Aluminum Arsenic Lead	>321 0.31-3.1 4490-44,900	mg/kg, ww	Site specific NOAEL to LOAEL range	Protection of carnivorous mammals from adverse effects on growth, survival, and/or reproductive success
Wetland/Creek	Surface Water	Aluminum Arsenic Cadmium Copper Iron Lead Zinc	50 40 30 40 30,000 40 10	ug/L	Literature based toxicity information	Protection of amphibians from adverse effects on growth, survival, and/or reproductive success.

Footnote: The units represent wet weight (ww). To convert to dry weight, a mean percent concentration (33%) should be used.

establishment of a 400 ppm risk-based surface soil clean-up goal would mean surface soil concentrations no greater than 400 ppm. With a surface soil concentration of 400 ppm and considering the nature of the contamination, clean up of surface soils to 400 ppm in the area of the wrecker building and truck wash should allow for the protection of groundwater.

Table 2-17 presents the risk-based (human health and ecological) remedial goals for surface soil, subsurface soil, and sediment.

2.7.2 Remedial Action Objectives

The remedial action objectives (RAOs) for the Ross Metals Site are as follows:

Soil

- prevent ingestion, inhalation, or direct contact with surface soil that contain concentrations in excess of the Remedial Goals (RGs);

- prevent further migration and leaching of contaminants in surface and subsurface soil to groundwater that could result in groundwater contamination in excess of MCLs;

- prevent further migration of contaminants in surface soil/sediment to surface water that could result in groundwater contamination in excess of MCLs;

- prevent ingestion or inhalation of soil that contain concentrations in excess of the RGs;

Table 2-17 Remedial Goals		
Contaminant of Concern	**Remedial Goals**	**Basis**
Surface Soil (mg/kg)		
Aluminum	11,620	Avg. Background Concentration
Antimony	3	Hazard Quotient Level = 0.1
Arsenic	5	Avg. Background Concentration
Barium	505	Hazard Quotient Level = 0.1
Cadmium	7	Hazard Quotient Level = 0.1
Copper	293	Hazard Quotient Level = 0.1
Iron	16,100	Avg. Background Concentration
Lead	400	Protection of Human Health
Manganese	559	Avg. Background Concentration
Selenium	37	Hazard Quotient Level = 0.1
Vanadium	51	Hazard Quotient Level = 0.1
Subsurface Soil (mg/kg)		
Lead	400	Protection of groundwater
Wetlands Sediment (mg/kg)		
Aluminum	8,860	Avg. Background Concentration
Antimony	28.4 - 104	Protection of Ecological Receptors
Arsenic	5.58	Avg. Background Concentration
Cadmium	0.37 - 3.73	Protection of Ecological Receptors
Copper	22.4 - 101.5	Protection of Ecological Receptors
Lead	192 - 1,925	Protection of Ecological Receptors
Mercury	ND - 0.21	Protection of Ecological Receptors
Nickel	9.10	Avg. Background Concentration

Footnote: Values for protection of ecological receptors were obtained by using a mean percent moisture concentration (33%) to convert NOAEL/LOAEL ranges (wet weight basis) to a dry weight range.

ND - Not Detected

Wetlands

- reduce potential for exposure of contaminated sediments/soils and surface waters to ecological receptors;

- prevent transport and migration of Site contaminants to the adjacent uncontaminated wetlands and the Wolf River,

- restore impacted wetland communities; and

- prevent further degradation of the wetlands and the adjacent areas.

2.7.3 Extent of Source Material Contamination Above Remedial Goals

To facilitate the evaluation of potentially applicable removal action alternatives for the Site, solid media waste can be divided into four general categories based on physical and chemical characteristics:

- Waste slag (landfilled and stockpiled on Site)
- Contaminated soil (in old fenced area and landfill area)
- Building ruins
- Demolition debris (pavement)
- Contaminated sediment (in wetlands)

Results from previous investigations suggest that lead will be the "driver" in any remediation effort conducted at the Site. The presence of lead is sufficiently widespread that gearing a remediation effort to lead will also remediate other COC contamination, meaning that the extent of lead contamination serves as a good indicator of the extent of all the COC contamination at the RM Site. In addition, the ecological risk assessment concluded that of all the metals calculated to pose a potential risk, lead was determined to pose the highest risk to the ecological receptors at the Site.

Contaminated Solid Media in Old Fenced Area and Landfill

Based on excavations performed in the landfill at the north end of the Site in November 1996, an estimated 10,000 CY of buried landfill slag is present on Site. In addition, several stockpiles of waste slag are located in various on-Site buildings (see Figure 2-2). The building labeled "furnace and raw materials refinery" contains two waste slag stockpiles totaling about 700 CY. The buildings labeled "wrecker," "slag fixation," and "shipment" contain waste slag stockpiles of about 2,600; 700; and 2,000 CY, respectively. The total combined volume of the stockpiled waste slag is about 6,000 CY.

Lead-contaminated surface and subsurface soil is present in the landfill at depths of up to 5.5 feet bgs. Lead-contaminated surface soil is present throughout the fenced portion of the Site at depths of up to 1.5 feet beneath the pavement. Based on an area of 450 by 525 feet, the volume of waste soil is estimated as 13,125 CY.

Lead-contaminated subsurface soil was noted along the eastern edge of the wrecker building at depths up to 40 inches bgs. Lead-contaminated subsurface soil was also noted near the southeastern corner of the truck wash. Based on two 125-ft-square areas at depths from 1.5 to 3 feet, the volume of contaminated subsurface soil is estimated as 2,500 CY. Figures 7-1 and 7-2 indicate the extent of lead contamination in Site soils.

The deteriorating buildings are located within the fenced portion of the Site. The largest of the buildings is a sheet metal building labeled "furnace and raw materials refinery;" the building is roughly 25 to 30 feet high, 180 feet long, and 100 feet wide. After demolition and compaction, the combined volume of the building debris is not expected to exceed 27,000 cubic feet (CF) (1,000 CY). The buildings are in poor condition and constitute a safety hazard.

Additional demolition debris may be generated at the Site depending on the remedial action selected. About 20,000 square yards (SY) of asphalt and concrete pavement are located within the fenced portion of the Site. An 8-inch-thick concrete pad located within the landfill area covers about 1,333 SY. Therefore, the total area of pavement at the Site is about 21,333 SY (including asphalt and concrete). The volume of concrete and asphalt estimated for disposal is 3,700 CY.

Based on the estimated volumes of the landfilled and stockpiled slag, the total volume of slag is estimated to be about 16,000 CY.

Contaminated Sediment in Wetlands

In December 1997, EPA ERTC conducted sediment sampling to determine the extent of lead contamination in the wetland area adjacent to the old fenced area and landfill. Samples were collected from 0 to 6 inches in depth and analyzed at the Site by field portable X-ray fluorescence (XRF) to determine the extent of lead contamination above. Because RGOs based on protection of ecological receptors are presented as ranges, an acceptable goal within the range must be selected in order to calculate the volume of contaminated sediment in the wetlands. Because lead, as previously indicated, is so widespread and presents the highest risk to ecological receptors; a cleanup goal established for it that takes into account impact to wetlands, should also ensure cleanup of other COCs to acceptable levels. To determine an acceptable goal, a chart plotting cleanup goals versus area of wetlands to be excavated to obtain the cleanup goal was created and is shown in **Figure 2-22**. Figure 2-22 suggests that 800 mg/kg would be the most effective cleanup goal causing the least disturbance to the wetlands. Based on the XRF results, there are approximately 5.7 acres of material contaminated above 800 mg/kg lead. **Figure 2-23** illustrates the contaminated wetlands.

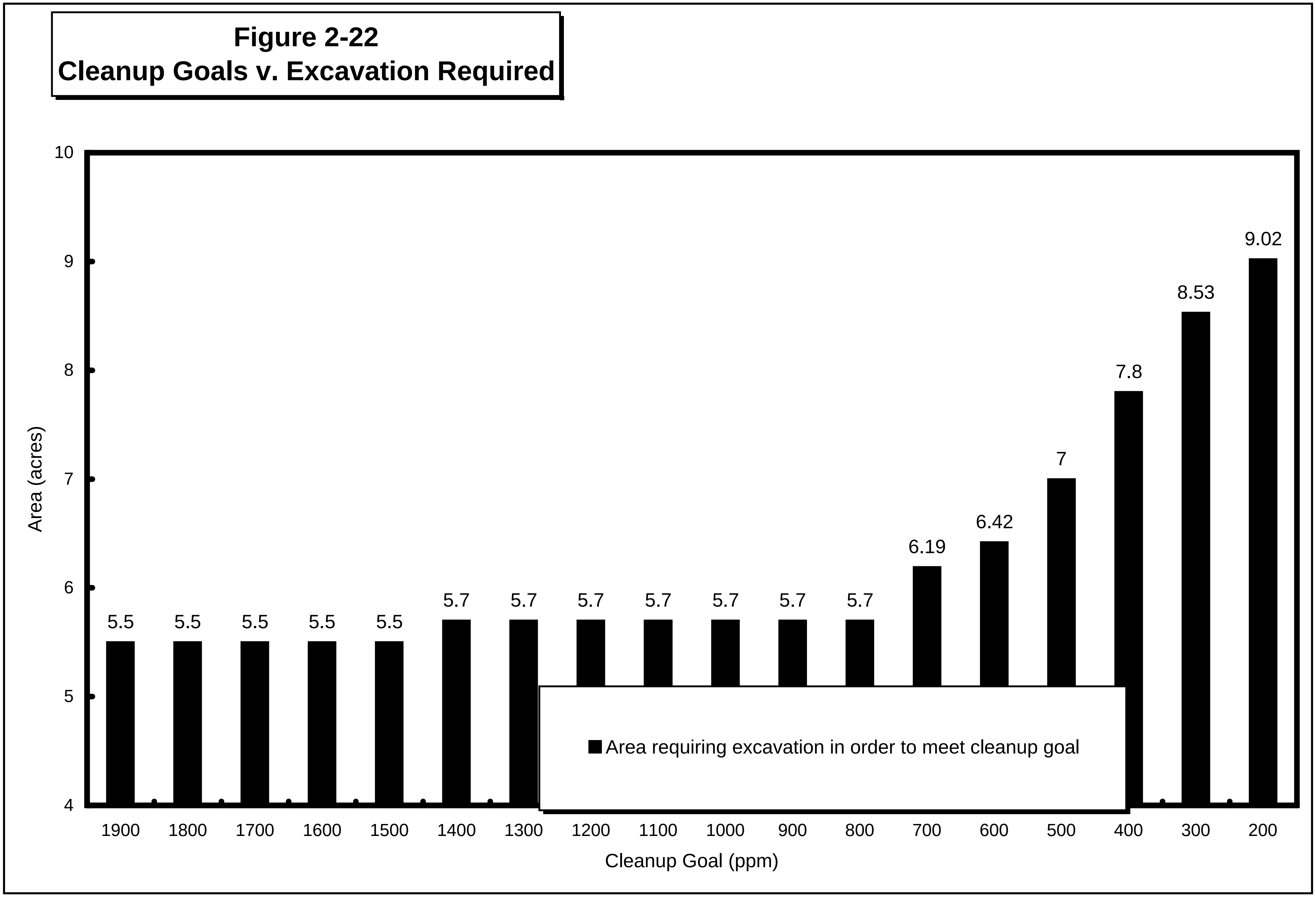
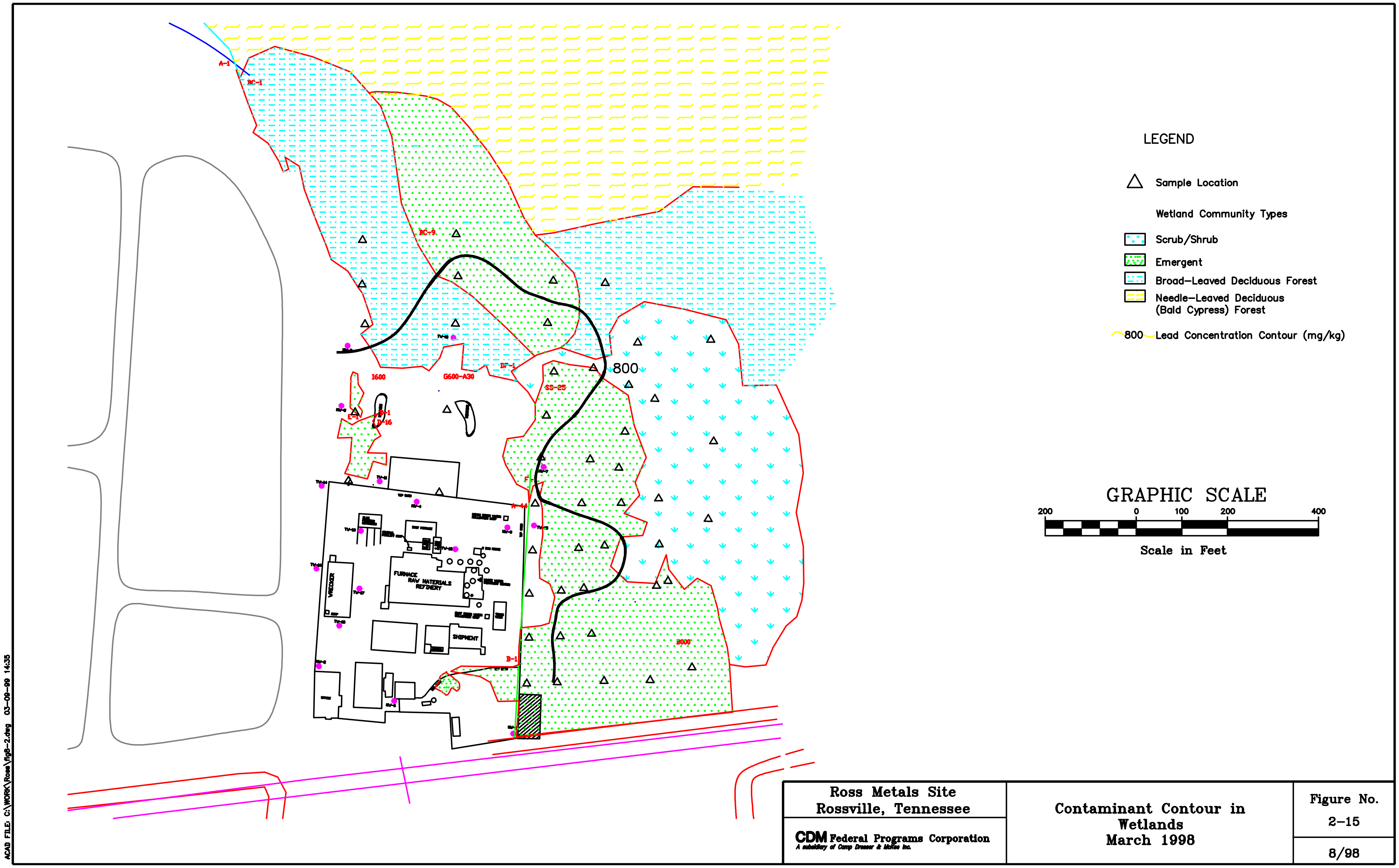


Figure 2-22
Cleanup Goals v. Excavation Required
Area (acres)
10
9
8
7
6
5
4
5.5
5.5
5.5
5.5
5.5
5.7
5.7
5.7
5.7
5.7
5.7
5.7
6.19
6.42
7
7.8
8.53
9.02
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
Cleanup Goal (ppm)
Area requiring excavation in order to meet cleanup goal



Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

Contaminant Contour in Wetlands
March 1998

Figure No.
2–15

8/98

Summary of Contaminated Solid Media

The total estimated volume of contaminated solid media includes the following components:

- Waste Slag

Landfill:	10,000 CY
Surface Slag:	6,000 CY

- Lead-contaminated Surface Soil (volume includes areas contaminated with other COCs)

Wetlands (sediment):	9,300 CY (at 800 ppm level)
Old Facility Fenced Area:	13,125 CY (at 400 ppm level)
Landfill Area:	8,750 CY (at 400 ppm level)

- Lead-contaminated Subsurface Soil 2,500 CY (at 400 ppm level)
- Lead-contaminated Buildings 1,000 CY (at 10 ug/dl level)
- Demolition Debris 3,700 CY

The contaminated solid media at the RM Site can be considered source material because it includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, to surface water, to air, or acts as a source for direct exposure. Because the contaminated solid media is considered source material, the concept of principal threat and low level threat wastes should be applied to the RM Site.

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Although no "threshold level" of risk has been established to identify principal threat waste, source materials with toxicity and mobility characteristics that pose a potential risk several orders of magnitude greater than the acceptable risk level for current or future land use can be considered principal threat wastes. For the RM Site, this would conservatively encompass solid media with lead concentrations ranging from 40,000 ppm, since the RGO for lead is 400 ppm in soil, and wetland sediment with lead concentrations ranging from 1,900 mg/kg upward since acute risk occurs at the LOAEL which is equal to 1,920 mg/kg.

Low level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of a release. They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.

The identification of principal threat and low level threat wastes is important because their presence influences the development of appropriate remedial alternatives. Although exceptions apply, EPA generally expects to use treatment to address the principal threats posed by a Site, wherever practicable. On the other hand, the use of institutional controls, such as containment, is expected for wastes that pose a relatively low long-term threat or where treatment is impracticable (EPA 1991).

A review of the sampling results suggests that some of the contaminated solid media present at the RM Site can be considered principal threat waste based on the lead concentrations present. Waste sample SL-01 and Site surface soil samples T4-LF/B12, 008SLA, and 013SLA all had lead concentrations greater than 40,000 ppm. In addition, the soil associated with sample 020SLA could be considered principal threat waste based on an arsenic concentration of 40 ppm.

Assuming an excavation depth of 1.5 ft bgs with a 50 foot x 50 foot excavation grid centered on each of the Site soil samples exceeding 40,000 ppm lead, and each of the wetland sediment samples exceeding 1,900 ppm lead, results in a volume of approximately 600 CY of contaminated soil and 8,200 CY of wetland sediment. Adding the 6,000 CY of stockpiled slag to this volume (based on the results of waste sample WS-01), and the 10,000 CY of landfilled slag (based on similarity to the stockpiled slag) results in a total volume of approximately 24,800 CY of the 53,275 CY of total contaminated solid media that could be considered principal threat waste.

2.8 DESCRIPTION OF SOURCE MATERIAL ALTERNATIVES

A summary of source material alternatives is provided in **Table 2-18.**

2.8.1 Alternative S-1 -- No Action

2.8.1.1 Description

Under this alternative, no action would be taken to remedy the contaminated surface soil, slag, sediment, or other solid media at the Site. The alternative would only involve the continued monitoring of structures, surface soil, slag, sediment, and surface water quality at the Site. Approximately five wipe samples (from buildings) and ten surface soil and fifteen surface water/sediment samples would be collected from the affected areas and analyzed for the PCOCs found in each medium every five years for 30 years. Public health evaluations would be conducted every five years and would allow EPA to assess the ongoing risks to human health and the environment posed by the RM Site. The evaluations would be based on the data collected from media monitoring.

2.8.1.2 Overall Protection of Human Health and the Environment

The no action alternative does not eliminate any exposure pathways or reduce the level of risk of the existing soil contamination.

Table 2-18

Summary of Soil Alternatives Evaluation

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	$100,247
2 -- Capping	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the Site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,735,804 Opt.2-$1,712,412
3 -- Capping With Pavement In Place	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the Site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,453,803 Opt.2-$1,430,411
4 -- Capping With Construction of Above-Ground Disposal Cell	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the Site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$1,506,847 Opt.2-$1,481,865

Note: Option 1 includes excavated wetland sediment; Option 2 does not.

Table 2-18 (cont)

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
5A -- Excavation and Onsite Treatment With Solidification/ Stabilization and Onsite Disposal	Eliminates exposure pathways and reduces the level of risk. Immobilizes contamination and eliminates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1- $4,907,274 Opt.2-$4,244,992
5B -- Excavation and Onsite Treatment With Solidification/ Stabilization and Offsite Disposal	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	ARARs are met through onsite treatment and offsite disposal.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	None	<1	Opt.1-$7,477,199 Opt.2-$6,181,160
6A -- Capping With Excavation and Onsite Treatment And Disposal Of Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain.	<1	Opt.1-$3,175,137 Opt.2-$2,729,543
6B -- Capping With Excavation and Onsite Treatment And Offsite Disposal Of Treated Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain	<1	Opt.1-$4,936,044 Opt.2-$4,013,508

Note: Option 1 includes excavated wetland sediment; Option 2 does not.

2.8.1.3 Compliance with ARARs

This alternative does not achieve the RAOs or chemical-specific ARARs established for surface soil. Location- and action-specific ARARs do not apply to this alternative since further remedial actions will not be conducted.

2.8.1.4 Long-Term Effectiveness and Permanence

The remediation goals derived for protection of human health and the environment would not be met. Because contaminated soil remains under this alternative, a review/reassessment of the conditions at the Site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

2.8.1.5 Reduction of M/T/V Through Treatment

No reductions in contaminants M/T/V are realized under this alternative.

2.8.1.6 Short-Term Effectiveness

Since no further remedial action would be implemented at this Site, this alternative poses no short-term risks to onsite workers. It is assumed that Level D personnel protection would be used when sampling various media.

2.8.1.7 Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

2.8.1.8 Cost

Minimal costs are associated with this alternative compared to other remedial action alternatives. No capital costs are associated with this alternative. The estimated O&M costs for media sampling associated with monitoring are approximately $100,247.

2.8.2 Alternative S-2 -- Capping

2.8.2.1 Description

Capping the contaminated solid media at the RM Site would serve to prevent rainfall infiltration and future leaching into the groundwater. In addition, capping also would limit direct contact exposure to contaminated media under the cap. Varying degrees of capping can be implemented depending on the severity of contaminants in the area. Caps can range from a simple natural soil cap to a multilayer soil/synthetic cap. This alternative evaluates a geosynthetic cap for implementation. This type of cap would produce a low permeability barrier sufficient to reduce contaminant migration.

This alternative includes the demolition of most of the on-Site pavement and buildings. The main office building and the pavement immediately surrounding this building would remain on Site, and landfilled slag would remain in place. Contaminated soil beneath the pavement would be excavated up to a 3 ft maximum depth and consolidated with the stockpiled slag, pavement, and building debris. This waste material would be disposed in an on-Site excavation that would extend from the existing landfill to about 375 feet south of the landfill. This disposal area would be about 400 feet wide and 8 feet deep, although could be enlarged somewhat if necessary. A geosynthetic cap and underlying 1.5-ft soil cushion layer would be added above the waste and existing landfill to cover about 6.7 acres. A 1.2-ft soil cover and 6-inch topsoil layer would be placed over the entire Site. These components are outlined as follows:

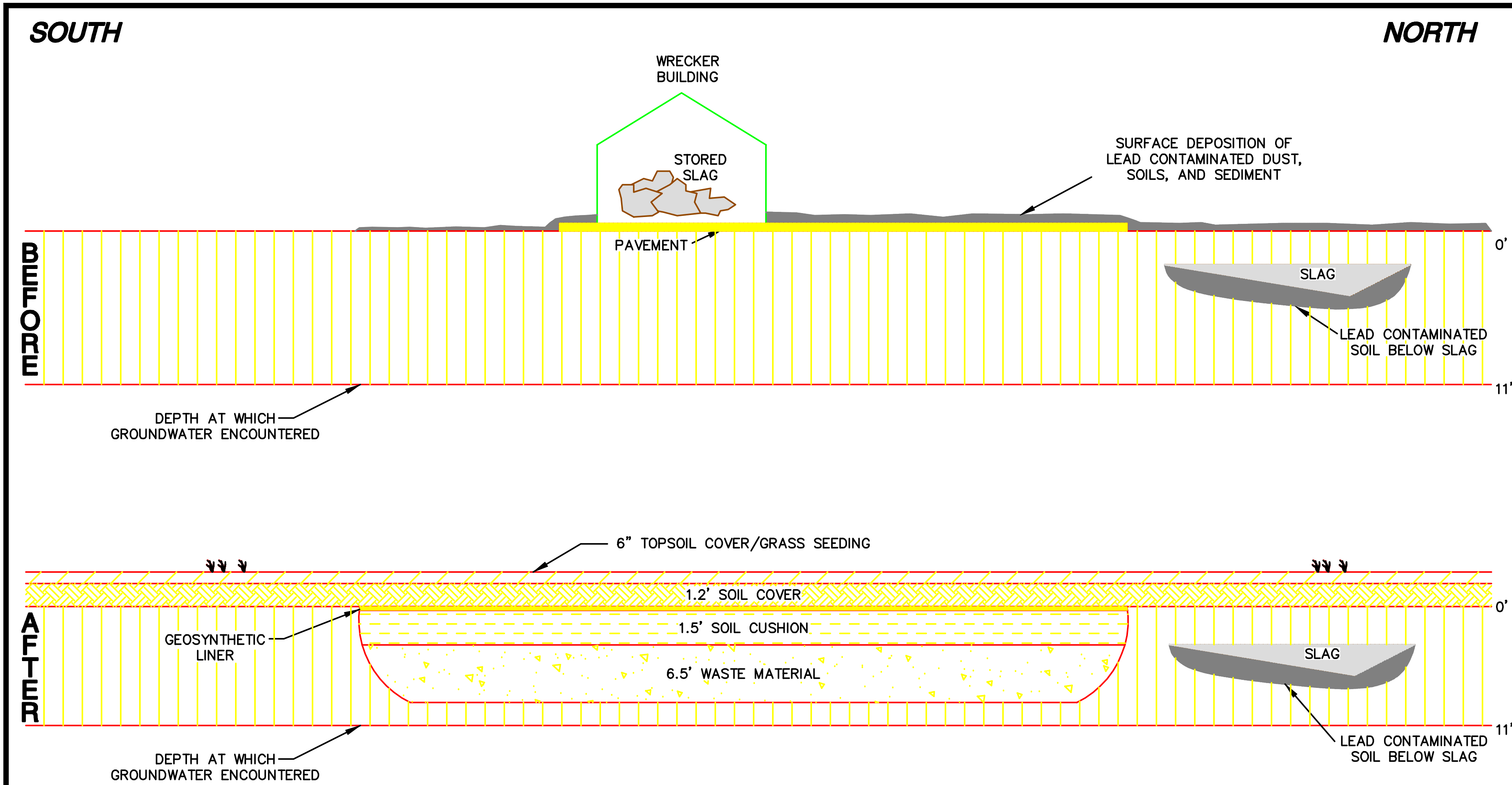
- Demolition of pavement and buildings;
- Excavation of onsite contaminated soil (15,625 CY);
- Excavation of an on-Site disposal area (375 ft long by 400 ft wide by 8 ft deep; approximately 36,200 CY subsurface soil);
- Compaction of 26,325 CY of waste material (15,625 CY of waste soil; 6,000 CY of stockpiled slag; 3,700 CY of pavement; and 1,000 CY of building debris) into disposal area (Compaction of 35,625 CY of waste material if excavated wetland sediment is consolidated with surface soil for final disposition);
- Installation of 1.5-ft-deep soil cushion over the waste and existing landfill (20,300 CY);
- Installation of geomembrane liner and geotextile over soil cushion (6.7 acres);
- Soil cover (1.2 ft deep), topsoil cover (6 inches deep), and grass seeding over the Site (8 acres); and
- Land/deed use restrictions and fencing.

The topsoil layer of the cap would be graded to a minimum slope of 3% and a maximum of 5% to promote surface drainage away from the waste cell and reduce infiltration. Surface drainage controls would be constructed around the perimeter of the cap to collect surface water runoff.

Alternative S-2 would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, minimize contaminant migration to groundwater, and eliminate contaminant migration to surface water from the Site. **Figure 2-24** illustrates the components of the cap included in this alternative as they would be applied to the RM Site.

2.8.2.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to



APPROXIMATE DIMENSIONS OF EXCAVATION: TOTAL DEPTH – 8 FT.
LENGTH – 375 FT.
WIDTH – 400 FT.

NOT TO SCALE

NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design Representation of waste material includes excavated wetland sediments.

Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
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Alternative 2 – Capping

Figure No.
2-24

8/98

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waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) minimizing the migration of contaminants to groundwater and eliminating the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the Site would be demolished and disposed of in an excavated disposal area beneath the existing pavement. As a result, physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on Site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

2.8.2.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the National Flood Insurance Program (NFIP) and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee Solid Waste Processing and Disposal (SWPD) Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

! Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on National Wetland Inventory (NWI) maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act (CWA), and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act (TWPCA), steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The Tennessee Air Pollution Control Regulations (TAPCR) dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.2.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented in order to maintain effectiveness.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

2.8.2.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the Site. Consolidation and capping would isolate waste source areas and would reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous Site investigations, 600 CY of surface soil and 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and Site conditions does not suggest that these situations would apply to the RM Site.

2.8.2.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.2.7 Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than the capping of contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

2.8.2.8 Cost

The total present worth for S-2 is approximately $1,735,804 for Option 1, which includes the excavated wetlands sediment, and $1,712,412 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,575,908, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,552,516, and the estimated O&M cost is approximately $159,895.

2.8.3 Alternative S-3 -- Capping With Pavement in Place

2.8.3.1 Description

Alternative S-3 differs from Alternative S-2 in that the waste is not disposed of in an excavation, but rather spread over the existing pavement and capped in place with the existing landfill. Alternative S-3 includes the demolition of most of the on-Site buildings. The main office building would remain on Site, and the landfilled slag would remain in place. Contaminated soil from areas not covered by pavement would be excavated and consolidated with the stockpiled slag and building debris, and excavated wetland sediment. This waste material would be spread above the pavement that extends from the existing landfill to about 375 feet south of the landfill. A geosynthetic cap and underlying 1.5-ft soil cushion layer would be added above the waste and existing landfill and would cover about 6.7 acres. The totsl height of the capped area would be and existing landfill and would cover approximately 6.7 acres. The total height of the capped area would be approximately 5 feet. A 1-ft soil cover and 6-inch topsoil layer would be placed over the entire Site. The components of this alternative are outlined as follows:

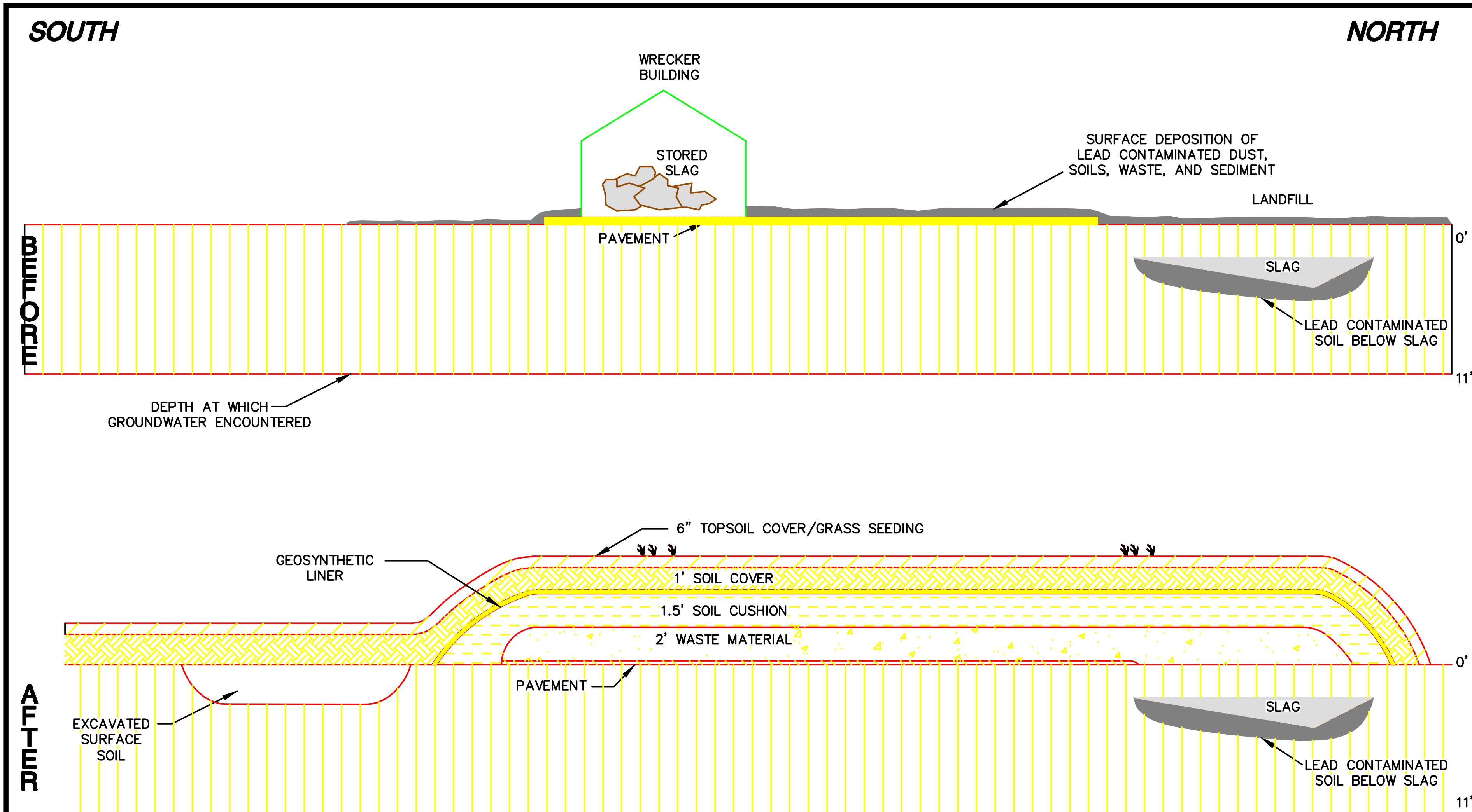
- Demolition of buildings;
- Excavation of contaminated soil in southeastern corner of the Site (2,800 CY);
- Compaction of 9,800 CY of waste material above pavement and landfill (2,800 CY of waste soil; 6,000 CY of stockpiled slag; and 1,000 CY of building debris) (Compaction of 19,100 CY of waste material if excavated wetlands sediment is consolidated with surface soil for final disposition);
- Installation of 1.5-ft-deep soil cushion over waste and existing landfill (20,300 CY);
- Installation of geomembrane liner and geotextile over soil cushion (6.7 acres);
- Soil cover (1 ft deep), topsoil cover (6 inches deep), and grass seeding over Site (8 acres); and
- Land use/deed restrictions and fencing.

The topsoil layer of the cap would be graded to a minimum slope of 3% and a maximum of 5% to promote surface drainage away from the waste cell and reduce infiltration. Surface drainage controls would be constructed around the perimeter of the cap to collect surface water runoff.

Alternative S-3 would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, further minimize contaminant migration to groundwater, and eliminate contaminant migration to surface water from the Site. **Figure 2-25** illustrates the components of the cap included under this alternative as applied to the RM Site.

2.8.3.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to



APPROXIMATE DIMENSIONS OF EXCAVATION: TOTAL DEPTH – 5 FT.
LENGTH – 600 FT.
WIDTH – 400 FT.

NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design
Representation of waste material includes excavated wetland sediments.

Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
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Alternative 3 – Capping With Pavement in Place

Figure No.
2–25

8/98

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waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative S-2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the Site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the Site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on Site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

2.8.3.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

! Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.3.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would to need be periodically inspected, and required maintenance would need to be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

2.8.3.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the Site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous Site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and Site conditions does not suggest that these situations would apply to the RM Site.

2.8.3.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.3.7 Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

2.8.3.8 Cost

The total present worth for Alternative S-3 is approximately $1,453,803 for Option 1, which includes the excavated wetlands sediment, and $1,430,411 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,293,907, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,270,515, and the estimated O&M cost is approximately $159,895.

2.8.4 Alternative S-4 -- Capping With Construction of Above-Ground Disposal Cell

2.8.4.1 Description

Alternative S-4 differs from Alternatives S-2 and S-3 in that waste is not disposed of in the area of the existing pavement; instead, it is consolidated over the surface of the existing landfill and capped in place. This method would result in a disposal cell approximately 15 feet high throughout the landfill area. This alternative includes the demolition of most of the on-Site pavement and buildings. The main office building and the pavement immediately surrounding this building would remain on Site, and landfilled slag would remain in place. Contaminated soil beneath the pavement would be excavated up to a 3 ft maximum depth and consolidated with the stockpiled slag, pavement, and building debris. This alternative includes the following components:

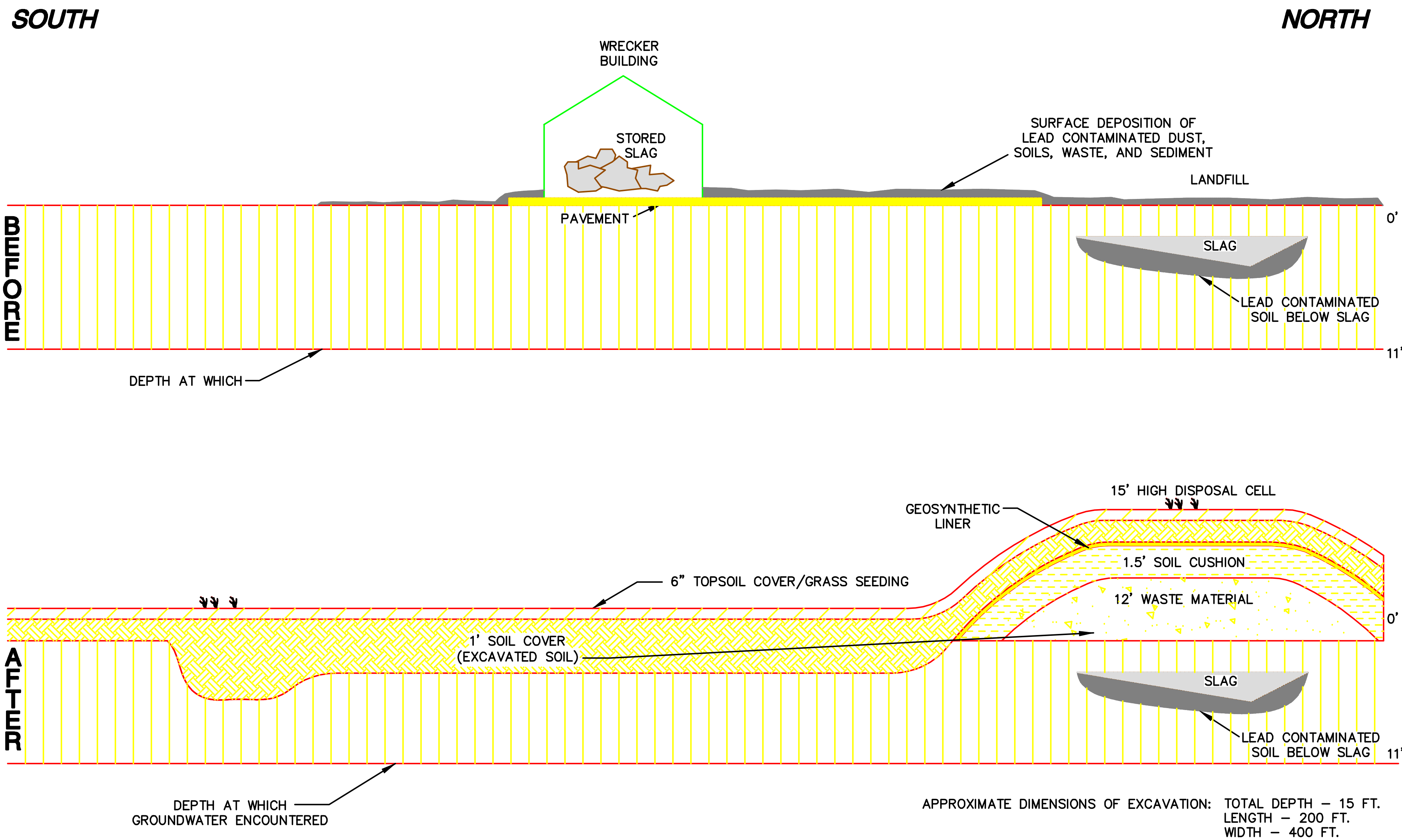
- Demolition of pavement and buildings;
- Excavation of onsite contaminated soil (15,625 CY);
- Compaction of 26,325 CY of waste material (15,625 CY of waste soil; 6,000 CY of stockpiled slag; 3,700 CY of pavement; and 1,000 CY of building debris) in existing landfill area with a cell height of about 12 to 13 feet (Compaction of 35,625 CY of waste material, with a cell height of 15 feet if excavated wetlands sediment are consolidated with surface soils for final disposition;
- Installation of 1.5-ft-deep soil cushion over the waste and existing landfill (7,600 CY);
- Installation of geomembrane liner and geotextile over soil cushion (2.5 acres);
- Soil cover (1 ft deep), topsoil cover (6 inches deep), and grass seeding over the Site (8 acres); and
- Land use restrictions and security fencing.

Surface drainage controls would be constructed around the perimeter of the cap to collect surface water runoff.

Alternative S-4 would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, minimize contaminant migration to groundwater, and eliminate contaminant migration to surface water from the Site. **Figure 2-26** illustrates the components of the cap included under this alternative as applied to the RM Site.

2.8.4.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) further reduce the migration of contaminants to



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NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design. Representation of waste material includes excavated wetland sediments.

Ross Metals Site Rossville, Tennessee CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*	Alternative 4 – Capping With Construction of Above Ground Disposal Cell	Figure No. 2–26 8/98

groundwater over Alternative S-2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the Site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted over the landfill area. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on Site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

2.8.4.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

! Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.4.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

2.8.4.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the Site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

Based on sample results collected during previous Site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991).

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and

Site conditions does not suggest that these situations would apply to the RM Site.

2.8.4.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.4.7 Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping contaminated material in a floodplain, no significant construction issues are expected to be encountered.

No state or federal permits are expected to be required; however, advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

2.8.4.8 Cost

The total present worth for Alternative S-4 is approximately $1,506,847 for Option 1, which includes the excavated wetlands sediment, and $1,481,865 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $1,346,951, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $1,321,970, and the estimated O&M cost is approximately $159,895.

2.8.5A Alternative S-5 -- Excavation And Onsite Treatment With Solidification/Stabilization Option A - Onsite Disposal of Treated Waste

2.8.5A.1 Description

Option A for Alternative S-5 includes the decontamination and demolition of most of the on-Site pavement and buildings. The main office building and the pavement immediately surrounding this building would remain on Site. The building debris and pavement would be decontaminated by steam/pressure cleaning. Contaminated soil throughout the Site, and buried slag in the landfill would be excavated and consolidated with the stockpiled slag. Contaminants within soil and slag would be physically bound or enclosed within a stabilized mass (solidification), or chemical reactions would be induced between a stabilizing agent and the contaminant to reduce its mobility (stabilization). Solidification/stabilization treatment technologies include the addition of cement, lime, pozzolan, or silicate-based additives or chemical reagents that physically or chemically react with the contaminant.

Once treated and confirmed to be nonhazardous, the soil and slag would be consolidated with the pavement debris and disposed of in an on-Site, unlined excavation. The decontaminated building debris would be taken off Site to a metal recycling facility. The onsite disposal area would extend from the northern boundary of the existing landfill to about 100 feet north of the Site entrance and would be about 700 feet long, 250 feet wide and 8 feet deep. A 3.0-ft soil cover consisting of uncontaminated soil excavated from the disposal area and a 6-inch topsoil layer would be placed over the entire Site. The total height of the capped area would be approximately 4.5 feet. The components of this alternative are outlined as follows:

- Decontamination and demolition of pavement and buildings;
- Recycling of metal building debris;
- Excavation of contaminated soil (21,875 CY) and landfilled slag (10,000 CY);
- Stabilization or solidification of contaminated soil, stockpiled slag, and landfilled slag (about 60,150 tons or 78,750 tons if excavated wetlands sediment are consolidated with surface soil for final disposition);
- Excavation of on-Site disposal area (700 ft long by 250 ft wide by 8 ft deep);
- Compaction of 40,817 CY of waste material (52,771 CY of waste material if wetland sediment is included); assuming a 5% increase in volume due to stabilization/solidification;
- Soil cover (3.0 ft deep), topsoil cover (6 inches deep), and grass seeding over Site (8 acres);
- Land use restrictions and security fencing.

Alternative S-5 would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, and eliminate contaminant migration to groundwater and surface water from the Site. The final treatment system would depend upon the outcome of treatability testing and would be determined during the remedial design phase. The fixed material would be subjected to TCLP testing to determine if treatment has been effective, prior to placement in the excavated disposal area.

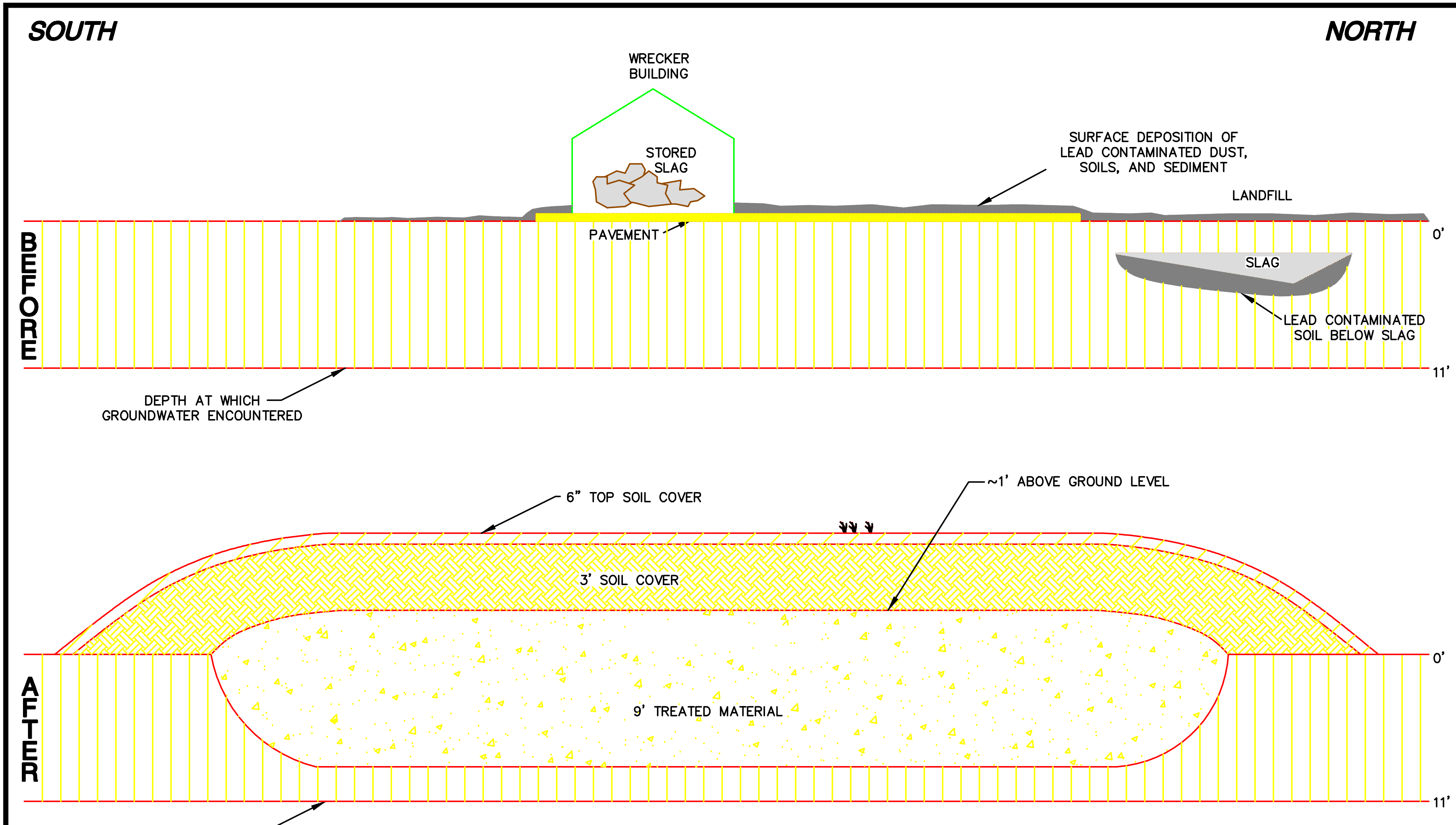
Figure 2-27 illustrates the component of the on-Site disposal area included under Alternative S-5A.

Treatability testing may be required to demonstrate contaminant immobilization for this treatment process and to help determine the volume increase caused by the solidification/stabilization process. One treatability study to evaluate stabilization reagents that would 1) reduce the leachability of lead in treated woodland sediment and 2) improve the material handling qualities of the sediment so that free liquids are not released during transport or disposal was completed in March 1998 (EPA 1998). The results of that study demonstrated that a biosolid product produced by N-Viro effectively reduced the leachibility of lead, absorbed free liquids and resulted in a material that could be excavated and transported for disposal.

Deed restrictions may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

2.8.5A.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would eliminate risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) eliminating the migration of contaminants to groundwater and surface water. The threat of direct human exposure to contaminated waste and physical hazards would be eliminated by this alternative. Treatment of the waste material would eliminate contaminant exposure through the receptor routes of ingestion and inhalation. Contaminated soil and slag would be treated and converted to a nonhazardous material. Structures throughout the Site would be demolished and either disposed of in an excavated disposal area beneath the existing pavement or recycled. As a result, physical hazards associated with deteriorating structures would be eliminated. Waste immobilized by treatment or removed by



APPROXIMATE DIMENSIONS OF EXCAVATION: TOTAL DEPTH (BELOW GROUND SURFACE) – 8 FT.
TOTAL HEIGHT (ABOVE GROUND SURFACE) – 4.5 FT.
LENGTH – 700 FT.
WIDTH – 250 FT.

NOT TO SCALE

ACAD FILE: ROSS\CAPALT5A

NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design Representation of waste material includes excavated wetland sediments.

Ross Metals Site Rossville, Tennessee **CDM** Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*	Alternative 5A Treatment and Onsite Disposal	Figure No. 2–27 8/98

decontamination would eliminate contaminant migration from the Site.

2.8.5A.3 Compliance with ARARs

The State of Tennessee SWPD rules are potentially applicable. The State may classify the on-Site disposal area for treated waste as a Class II (industrial waste) landfill facility. Class II facilities must meet the same requirements as Class I (solid waste) disposal facilities unless a waiver of one or more of the standards is obtained as set forth in SWPD Rule 1200-1-7-.01(5). Class I standards include requirements for landfill liners, geologic buffers, leachate collection systems, and other requirements that may not be necessary for the RM Site to be protective of human health and the environment. The SWPD rule also includes buffer zone standards for Class II facilities. These standards require that new facilities be located so that fill areas are, at a minimum, 100 feet from all property lines and 500 feet from all residences unless the owner agrees in writing to a shorter distance. A disposal area that is constructed to be about 700 feet by 250 feet would likely meet both the buffer zone and capacity requirements for the RM Site.

The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

In addition, EPA's regulations (40 CFR Part 6, Appendix A)for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The Protection of Wetlands Order (40 CFR 6) also requires that no adverse impacts to wetlands result from a remedial action. Historical evidence suggests that the existing landfill was created in a wetland. However, this area was not observed to contain standing water during sampling events conducted in 1996 and 1997. It is not known whether the area of the existing landfill would be classified as a wetland area.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this removal action.

All action-specific ARARs are expected to be met. The Tennessee Air Pollution Air Control Regulations (TAPCR) dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. If remedial equipment is used on Site such as a pugmill mixer or crusher, dust and vapors generated from the use of this equipment will be contained and treated before being discharged to the atmosphere, if required. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.5A.4 Long-Term Effectiveness and Permanence

If the disposal area is classified as a Class II disposal facility, the area may have to be maintained to ensure that it continues to perform as designed; consequently, monitoring, inspection, and maintenance would be required. The soil cover area would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected, and required maintenance could be implemented.

If the RM Site is not classified as a Class II disposal facility; monitoring, inspection, and maintenance may not be required. Treatment reagents are typically tested by the Multiple Extraction Procedure (MEP, SW-846 Method 1320) to measure long-term stability. The test is intended to approximate leachability under acidic conditions over a 1,000-year time frame. Based on successful completion of bench-scale testing that would include MEP analysis, this alternative is expected to provide adequate long-term effectiveness and permanence. Access restrictions such as land use controls and fencing may be required to prevent land uses incompatible with the Site.

2.8.5A.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant toxicity and mobility through treatment; contaminant volume would not be reduced. Contaminant toxicity would be reduced by altering the physical or chemical structure of the contaminant into a nonhazardous material. Contaminant mobility would be reduced by binding or bonding the contaminant into a nonleachable form that would eliminate contaminant migration from the Site. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

Based on sample results collected during previous Site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative meets EPA's expectation to use treatment to address the principal threats posed by a site by treating all the contaminated soil, sediment, and slag. However, treatment of what would be considered low-level threat waste does not meet EPA's expectation to use containment to address such waste, although in some situations, treatment rather than containment of low-level threats is warranted (EPA 1991).

2.8.5A.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation, consolidation, and treatment of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the decontamination and demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.5A.7 Implementability

Treatment of contaminated soil and slag is offered by numerous vendors. On-Site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 20 percent.

The dimensions of the Site property are about 450 by 800 feet, including the existing landfill. The waste storage capacity required for this alternative is 49,150 CY assuming a 20 percent volume increase of the treated material. To meet the SWDP buffer zone siting standards, the excavation area would be 700 by 250 feet, and with an 8-ft average depth, depending on the thickness of the clay unit. The disposal area would be located beneath the existing pavement.

Wastewater may be generated during implementation of this alternative through water runoff generated as a result of dust emission control. Wastewater may also be generated as a result of decontamination activities required for equipment and on-Site workers. Containment and treatment or disposal of these wastewaters may be required. Depending upon the treatment methodology selected, the wastewater may be able to be utilized in the soils treatment process.

The on-Site disposal area for the treated waste may be classified as a Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities would apply to the Site.

All services and materials for this alternative are readily available.

2.8.5A.8 Cost

The total present worth for Alternative S-5A is approximately $4,907,274 for Option 1, which includes the excavated wetlands sediment, and $4,244,992 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $4,743,474, and the estimated O&M cost is approximately $163,799. For Option 2, the estimated capital cost is approximately $4,081,193, and the estimated O&M cost is approximately $163,799.

2.8.5B Alternative S-5 -- Excavation And Onsite Treatment With Solidification/Stabilization Option B - Offsite Disposal of Treated Material

2.8.5B.1 Description

Option B for Alternative S-5 is similar to Option A in that it also consists of the decontamination and demolition of most of the on-Site pavement and buildings and on-Site treatment. The main office building and the pavement immediately surrounding this building would remain on Site. The building debris and pavement would be decontaminated by steam cleaning. The decontaminated building debris would be taken off Site to a metal recycling facility. Contaminated soil throughout the Site, and buried slag in the landfill would be excavated and consolidated with the stockpiled slag. Contaminants in soil and slag would be physically bound or enclosed within a stabilized mass (solidification), or chemical reactions would be induced between a stabilizing agent and the contaminants to reduce mobility (stabilization). Solidification/stabilization treatment technologies include the addition of cement, lime, pozzolan, or silicate-based additives or chemical reagents that physically or chemically react with the contaminant. Option B differs from Option A in that after treatment and confirmation that the soil is nonhazardous, the treated soil and slag would be hauled off Site to a disposal facility. A 1.0-ft soil cover and a 6-inch topsoil layer would be placed over the entire Site. These components are outlined as follows:

- Decontamination and demolition of pavement and buildings;
- Recycling of metal building debris;
- Excavation of contaminated soil (21,875 CY), and landfilled slag (10,000 CY);
- Stabilization or solidification of contaminated soil, stockpiled slag, and landfilled slag

(about 60,150 tons; or 78,750 tons if excavated wetlands sediment are consolidated with surface soil for final disposition);

- Off-Site disposal at nonhazardous disposal facility (63,158 tons assuming a 5 percent increase in volume during treatment; 82,688 tons if excavated wetland sediment is included); and

- Bacfill excavation, soil cover (1 ft deep), topsoil cover (6 inches deep), and grass seeding over Site (8 acres).

Alternative S-5B would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, and eliminate contaminant migration to groundwater and surface water from the Site.

Deed restrictions may be placed on the Site while the remedial action takes place. Monitoring would be required to assess effectiveness of the remedial action.

2.8.5B.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would eliminate risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) eliminating the migration of contaminants to groundwater and surface water. The threat of direct human exposure to contaminated waste and physical hazards would be eliminated by this alternative. Treatment and removal of the waste material would eliminate contaminant exposure through the receptor routes of ingestion and inhalation. Contaminated soil and slag would be treated and converted to a nonhazardous material and transported to an off-Site disposal facility. Structures throughout the Site would be demolished and either disposed of in an excavated disposal area beneath the existing pavement or recycled. As a result, physical hazards associated with deteriorating structures would be eliminated. Removal of waste would mitigate contaminant migration from the Site.

2.8.5B.3 Compliance with ARARs

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. If remedial equipment is used on Site, such as a pugmill mixer or crusher, dust and vapors generated from the use of this equipment will be contained and treated before being discharged to the atmosphere, if required. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.5B.4 Long-Term Effectiveness and Permanence

Treatment and removal of the waste material would not require monitoring, inspection, or maintenance for the Site. Treatment reagents are typically tested by MEP SW-846 Method 1320 to measure long-term stability. The test is intended to approximate leachability under acidic conditions over a 1,000-year time frame. Based on successful completion of bench-scale testing that would include MEP analysis, this alternative is expected to provide adequate long-term effectiveness and permanence. Access restrictions such as land use controls and fencing would likely not be required.

2.8.5B.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant toxicity and mobility through treatment; contaminant volume would not be physically reduced. Contaminant toxicity would be reduced by altering the physical or chemical structure of the contaminant into a nonhazardous material. Contaminant mobility would be reduced by binding or bonding the contaminant into a nonleachable form. Subsequent removal would mitigate contaminant migration from the Site. Contaminant volume would not be physically reduced under this alternative.

Based on sample results collected during previous Site investigations, 600 CY of surface soil and the

16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste. This alternative meets EPA's expectation to use treatment to address the principal threats posed by a site by treating all the contaminated soil, sediment, and slag. However, treatment of what would be considered low-level threat waste does not meet EPA's expectation to use containment to address such waste, although in some situations, treatment rather than containment of low-level threats is warranted (EPA 1991).

2.8.5B.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal. Short-term impacts are associated with excavation, consolidation and treatment of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during the decontamination and demolition of building structures and pavement. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Monitoring of dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water as needed to surfaces receiving heavy vehicular traffic or in excavation areas. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.5B.7 Implementability

Treatment of contaminated soil and slag is offered by numerous vendors. On-Site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of waste soil and slag material; however, a slight volume reduction may occur if a chemical reagent is used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment methodology used. An increase in the volume of the treated waste material will have an impact on the transportation costs to a disposal facility. Calculations used in the development of this alternative assume a volume increase of 20 percent.

Wastewater may be generated during implementation of this alternative through water runoff generated as a result of dust emission control. Wastewater may also be generated as a result of decontamination activities required for both equipment and on-Site workers. Containment and treatment or disposal of these wastewaters may be required. Depending upon the treatment methodology selected, the wastewater may be able to be utilized in the soils treatment process.

No state or federal permits are expected to be required; however, advance consultation should occur in planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

2.8.5B.8 Cost

The total present worth for Alternative S-5B is approximately $7,477,199 for Option 1, which includes the excavated wetlands sediment, and $6,181,160 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $7,313,400, and the estimated O&M cost is approximately $163,799. For Option 2, the estimated capital cost is approximately $6,017,361, and the estimated O&M cost is approximately $163,799.

2.8.6A Alternative S-6 -- Capping w/ Excavation & Onsite Treatment of Principal Threat Waste
Option A - Onsite Disposal of Treated Principal Threat Waste

2.8.6A.1 Description

Alternative S-6 is similar to Alternative S-5 in that it also includes the excavation and treatment of contaminated material via solidification/stabilization. However, Alternative S-6 differs from Alternative S-5 in that treatment is limited to that material that is considered principal-threat. As indicated in section 8.3, principal threat waste at the RM Site includes the landfilled and stockpiled slag, and approximately 500 CY of soil.

Option A for Alternative S-6 includes the demolition of most of the on-Site buildings. The main office building would remain on Site. The building debris and pavement would be decontaminated by steam/pressure cleaning. Onsite contaminated soil considered principal threat, and buried slag in the landfill would be excavated and consolidated with the stockpiled slag. In addition, above the RGO, contaminated soil from areas not covered by pavement, and non-principal-threat landfill soil would be excavated for placement in the excavated onsite landfill along with the treated principal-threat waste. This waste (and treated) material would be disposed in the excavated landfill area (450 x 250 ft x 5 ft deep). A geosynthetic cap and underlying 1.5-ft soil cushion layer would be added above the waste and existing landfill and would cover about 2.5 acres. A 1-ft soil cover and 6-inch topsoil layer would be placed over the entire Site. The capped disposal area would rise approximately 6 ft above ground surface.

For treatment, contaminants within soil and slag would be physically bound or enclosed within a stabilized mass (solidification), or chemical reactions would be induced between a stabilizing agent and the contaminant to reduce its mobility (stabilization). The decontaminated building debris would be taken offsite to a metal recycling facility. The components of this alternative are outlined as below:

- Decontamination and demolition of buildings;
- Recycling of metal building debris;
- Excavation of principal-threat contaminated soil (500 CY), landfilled slag (10,000 CY), and non-principal threat landfill soil (6,500 CY) to allow access to landfilled slag. (Excavation of an additional 8,200 CY of principal-threat contaminated sediment and 1,100 CY of non-principal threat contaminated sediment if contaminated wetlands sediments are excavated and consolidated with surface soils for final disposition);
- Stabilization or solidification of principal-threat contaminated soil, stockpiled slag, and landfilled slag (about 32,700 tons; 45,000 tons if principal-threat wetlands sediments are included);
- Excavation of on-Site disposal area (450 ft long by 250 ft wide by 5 ft deep) in landfill area;.
- Compaction of 23,825 CY of waste material; assuming a 5% increase in volume of principal-threat material due to stabilization/solidification, and no increase in volume of non-principal threat material (33,535 CY of waste material if contaminated wetlands sediments are excavated and consolidated with surface soils for final disposition);
- Installation of 1.5-ft-deep soil cushion over waste and treated material and low-level threat material capped in place (20,300 CY);
- Installation of geomembrane liner and geotextile over soil cushion (6.7 acres);
- Soil cover (1 ft deep), topsoil cover (6 inches deep), and grass seeding over Site (8 acres); and
- Land use restrictions and security fencing.

The final treatment system would depend upon the outcome of treatability testing and would be determined during the remedial design phase. The fixed material would be subjected to TCLP testing to determine if treatment has been effective, prior to placement in the excavated disposal area. Note that the components of this alternative are considered a conceptual design, but other designs may be possible. The final design would be based on requirements regarding construction in a floodplain.

Treatability testing may be required to demonstrate contaminant immobilization for this treatment process and to help determine the volume increase caused by the solidification/stabilization process.

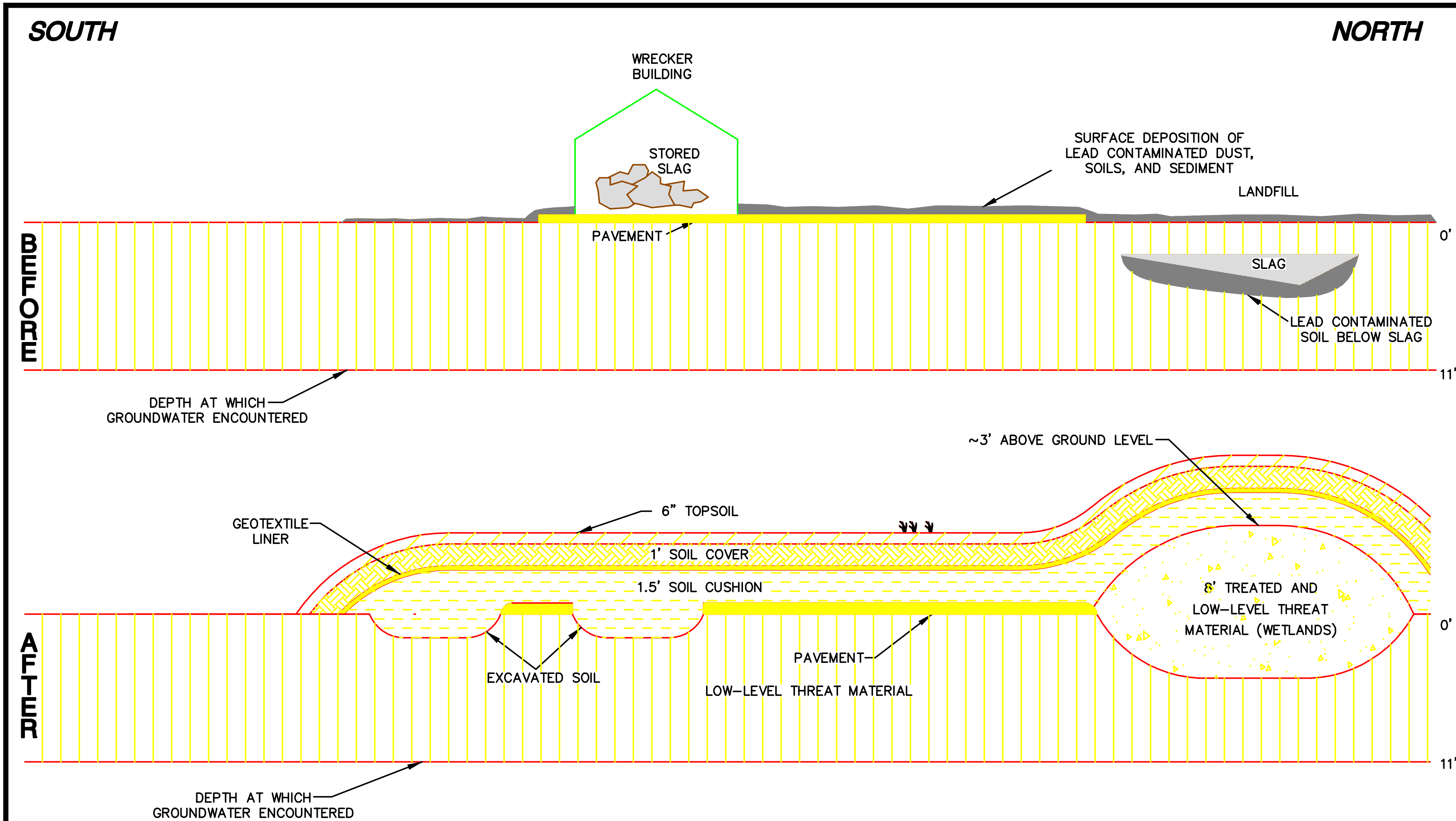
Land use restrictions and security fencing may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

The topsoil layer of the cap would be graded to a minimum slope of 3% and a maximum of 5% to promote surface drainage away from the waste cell and reduce infiltration. Surface drainage controls would be constructed around the perimeter of the cap to collect surface water runoff.

Option A of Alternative S-6 would eliminate direct contact with contaminated media, eliminate on-Site physical hazards, minimize contaminant migration to groundwater, and eliminate contaminant migration to surface water from the Site. **Figure 2-28** illustrates the components of the cap included under Alternative S-6A as applied to the RM Site.

2.8.6A.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) further reduce the migration of contaminants to



APPROXIMATE DIMENSIONS OF EXCAVATION: TOTAL DEPTH (BELOW GROUND SURFACE) – 5 FT.
TOTAL HEIGHT (BELOW GROUND SURFACE) – 6 FT.
LENGTH – 250 FT.
WIDTH – 450 FT.

NOT TO SCALE

NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design. Representation of waste material includes excavated wetland sediments.

Ross Metals Site
Rossville, Tennessee

CDM Federal Programs Corporation
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Alternative 6A
Treatment W/Onsite Disposal
of Treated Principal Threat Waste

Figure No.
2–28

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groundwater over Alternative S-2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of the waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the Site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the Site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on Site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.

2.8.6A.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

! Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.6A.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected and maintained.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

2.8.6A.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the Site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would meet EPA's expectation to use treatment to address the principal threats posed by a site, as well as EPA's expectation to use containment to address low-level threats posed by a site. Based on sample results collected during previous Site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

2.8.6A.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.6A.7 Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping treated and low level-threat material in a floodplain, no significant construction issues are expected to be encountered.

Treatment of contaminated soil and slag is offered by numerous vendors. On-Site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 5 percent.

The on-Site disposal area for the treated waste may be classified as a Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities would apply to the Site.

All services and materials for this alternative are readily available.

2.8.6A.8 Cost

The total present worth for Alternative S-6A is approximately $3,175,137 for Option 1, which includes the excavated wetlands sediment, and $2,729,543 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $3,015,241, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $2,569,647, and the estimated O&M cost is approximately $159,895.

2.8.6B Alternative S-6 -- Capping w/ Excavation & Onsite Treatment of Principal Threat Waste
Option B - Offsite Disposal of Treated Principal-Threat Waste

2.8.6B.1 Description

Option B is similar to Option A except that treated principal-threat waste is disposed offsite in a RCRA subtitle D landfill rather than being capped onsite with the low-level threat waste. Like Option A, Option B for Alternative S-6 includes the demolition of most of the on-Site buildings. The main office building would remain on Site. The building debris and pavement would be decontaminated by steam/pressure cleaning. Onsite contaminated soil considered principal threat, and buried slag in the landfill would be excavated and consolidated with the stockpiled slag. In addition, contaminated soil from areas not covered by pavement, and non-principal-threat landfill soil would be excavated for placement in the excavated onsite landfill. This low level-threat waste material would be disposed in the excavated landfill area (450 x 250 ft x 5 ft deep). A geosynthetic cap and underlying 1.5-ft soil cushion layer would be added above the waste and existing landfill and would cover about 2.5 acres. A 1-ft soil cover and 6-inch topsoil layer would be placed over the entire Site.

For treatment, contaminants within soil and slag would be physically bound or enclosed within a stabilized mass (solidification), or chemical reactions would be induced between a stabilizing agent and the contaminant to reduce its mobility (stabilization). The decontaminated building debris would be taken offsite to a metal recycling facility. The components of this alternative are outlined as below:

- Decontamination and demolition of buildings;
- Recycling of metal building debris;
- Excavation of principal-threat contaminated soil (500 CY), landfilled slag (10,000 CY), and non-principal threat landfill soil (6,500 CY) to allow access to landfilled slag. (Excavation of an additional 8,200 CY of principal-threat contaminated wetland sediment and 1,100 CY of non-principal threat contaminated wetland sediment if contaminated wetland sediments are excavated and consolidated with surface soil for final disposition);
- Stabilization or solidification of principal-threat contaminated soil and wetland sediment, stockpiled slag, and landfilled slag (about 32,700; 45,000 tons if contaminated wetland sediments are excavated and consolidated with surface soils for final disposition);
- Excavation of on-site disposal area (450 ft long by 250 ft wide by 5 ft deep) in landfill area;
- Compaction of 6,500 CY of low-level (non-principal threat) waste material (7,600 CY if contaminated wetland sediments are excavated and consolidated with surface soil for final disposition;

- Offsite disposal of 34,335 tons of treated principal-threat waste (assuming 5% increase in volume due to treatment) in RCRA Subtitle D landfill (47,250 tons if contaminated wetlands sediment are excavated and consolidated with surface soil for final disposition);

- Installation of 1.5-ft-deep soil cushion over waste and treated material and low-level threat material capped in place (20,300 CY);

- Installation of geomembrane liner and geotextile over soil cushion (6.7 acres);

- Soil cover (1 ft deep), topsoil cover (6 inches deep), and grass seeding over Site (8 acres); and

- Land use restrictions and security fencing.

The final treatment system would depend upon the outcome of treatability testing and would be determined during the remedial design phase. The fixed material would be subjected to TCLP testing to determine if treatment has been effective, prior to placement in the excavated disposal area. Note that the components of this alternative are considered a conceptual design, but other designs may be possible. The final design would be based on requirements regarding construction in a floodplain.

Treatability testing may be required to demonstrate contaminant immobilization for this treatment process and to help determine the volume increase caused by the solidification/stabilization process.

Land use restrictions and security fencing may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

The topsoil layer of the cap would be graded to a minimum slope of 3% and a maximum of 5% to promote surface drainage away from the waste cell and reduce infiltration. Surface drainage controls would be constructed around the perimeter of the cap to collect surface water runoff.

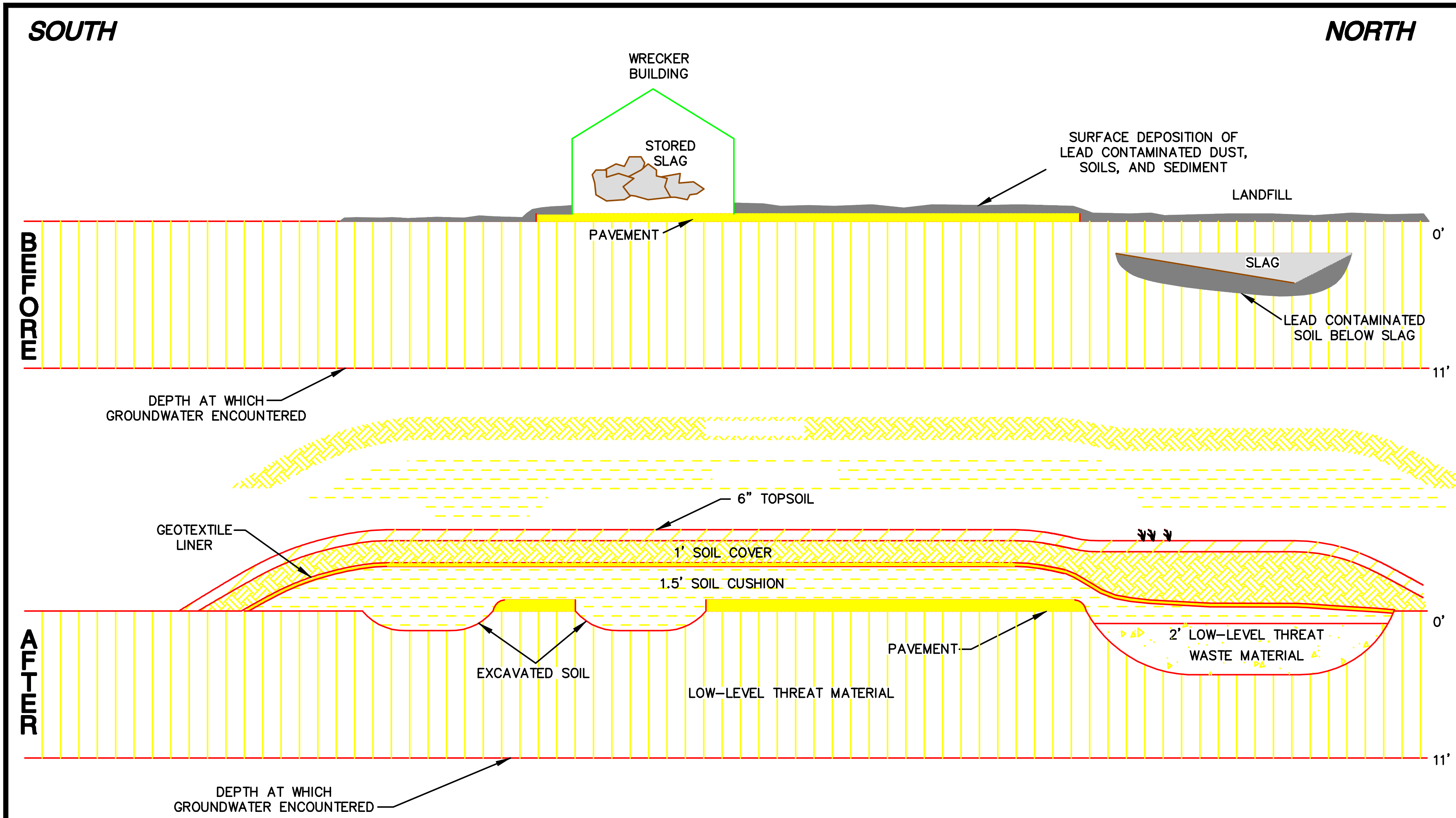
Option B of Alternative S-6 would eliminate direct contact with contaminated media, eliminate on-

Site physical hazards, minimize contaminant migration to groundwater, and eliminate contaminant migration to surface water from the Site. **Figure 2-29** illustrates the components of the cap included under Alternative S-6B as applied to the RM Site.

2.8.6B.2 Overall Protection of Human Health and the Environment

Successful implementation of this alternative would reduce risks to human health and the environment and meet the removal action objectives by (1) eliminating exposure of residents and trespassers to waste material by direct contact and airborne migration, (2) eliminating exposure of trespassers to direct contact with on-Site physical hazards, and (3) further reduce the migration of contaminants to groundwater over Alternative S-2 and eliminate the migration of contaminants to surface water. Consolidation and isolation of low level-threat waste material beneath a geomembrane cap would eliminate receptor routes of exposure through ingestion and inhalation. Structures throughout the Site would be demolished and disposed of in the disposal area above the existing pavement and landfill area. The waste material would be spread and compacted throughout the Site. Physical hazards associated with deteriorating structures would be eliminated. In addition, geomembrane capping would eliminate infiltration of precipitation and surface water that contributes to the migration of contaminants to groundwater. However, because the waste material will remain on Site, contaminant migration to groundwater cannot be discounted as an adverse effect. Nevertheless, the elimination of surface water infiltration makes this scenario unlikely, and contaminant migration through surface water runoff to the adjacent wetlands and the Wolf River would be eliminated.

The threat of direct human exposure to contaminated waste and physical hazards would be practically eliminated by this alternative; however, the threat could return over the long term if cap integrity was compromised. The potential for ingestion, dermal contact, and inhalation of soil containing metals would be eliminated by successfully placing the geomembrane cap over the waste material.



APPROXIMATE DIMENSIONS OF EXCAVATION: TOTAL DEPTH – 5 FT.
LENGTH – 250 FT.
WIDTH – 450 FT.

NOT TO SCALE

NOTE: Conceptual design. Federal, state, and local requirements regarding construction in a floodplain must be considered and may affect design
Representation of waste material includes excavated wetland sediments.

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Rossville, Tennessee

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Alternative 6B
Treatment W/Offsite Disposal of Treated Principal Threat Waste

Figure No.
2-29

8/98

ACAD FILE: ROSS\CAPALT6B

2.8.6B.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and

! The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

Wetlands are located to the north and northeast of the facility and landfill, although these locations are not identified on NWI maps. The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;

- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;

- the landfill will not cause or contribute to significant degradation of wetlands;

- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and

- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.8.6B.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. However, the cover would be periodically inspected, and required maintenance could be implemented.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses that are incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

2.8.6B.5 Reduction of M/T/V Through Treatment

The primary objective of this alternative is to reduce contaminant mobility by isolating contaminants from receptor contact; contaminant volume or toxicity would not be reduced. Contaminant mobility would be reduced by installing an impermeable cap liner. The liner would eliminate surface water or precipitation infiltration and would greatly reduce contaminant migration to groundwater in conjunction with the existing clay unit beneath the Site. Consolidation and capping would isolate waste source areas and reduce contaminant mobility resulting from surface water transport and wind erosion. Contaminant mobility is expected to be reduced to an extent that would result in overall risk reduction from all pathways and exposure routes.

This alternative would meet EPA's expectation to use treatment to address the principal threats posed by a Site, as well as EPA's expectation to use containment to address low-level threats posed by a site. Based on sample results collected during previous Site investigations, 600 CY of surface soil and the 16,000 CY of stockpiled and landfilled slag would be considered "principal-threat" waste.

2.8.6B.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation and consolidation of waste soil and slag; however, these potential, short-term impacts would be mitigated during the construction phase.

If the excavated material is dry, on-Site workers will be exposed to waste soil and slag dust during excavation and consolidation activities. Additional exposure to lead dust may occur during building structure and pavement demolition. Ingestion of dust could involve some health effects because of the high level of metals in waste soil and slag.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.8.6B.7 Implementability

Construction of a geomembrane surface cap is a standard construction practice. Other than capping low level-threat material in a floodplain, no significant construction issues are expected to be encountered.

Treatment of contaminated soil and slag is offered by numerous vendors. On-Site treatment utilizes standard construction practices and material handling equipment. No significant construction issues are expected to be encountered.

Treatment of the contaminated waste will likely increase the volume of the waste soil and slag material; however, slight volume reductions may occur when some chemical reagents are used to treat the material. Typical volume increases range from about 5 percent to as high as 100 percent, depending upon the treatment method used. An increase in the volume of the treated waste material will have an impact on the disposal volume required. Calculations used in the development of this alternative utilized a volume increase estimate of 5 percent.

All services and materials for this alternative are readily available.

2.8.6B.8 Cost

The total present worth for Alternative S-6B is approximately $4,936,044 for Option 1, which includes the excavated wetlands sediment, and $4,013,508 for Option 2, which does not include the wetland sediment. For Option 1, the estimated capital cost is approximately $4,776,149, and the estimated O&M cost is approximately $159,895. For Option 2, the estimated capital cost is approximately $3,853,613 and the estimated O&M cost is approximately $159,895.

2.9 WETLAND SEDIMENT ALTERNATIVE ANALYSIS

The alternatives that were selected for surface soil at the RM Site include no action, institutional controls and off-Site creation of wetlands, surface water and sediment control/diversion with off-Site creation of wetlands, composting/fixation of wetlands sediment with off-Site creation of wetlands, capping with off-Site creation of wetlands, and excavation and grading with either clean fill or composting and revegetation. **Table 2-19** is a summary of the wetland alternatives considered.

2.9.1 Alternative W-1 -- No Action

2.9.1.1 Description

Under this alternative, no remedial action would be taken with respect to the wetlands. A monitoring program would be implemented to address wetland sediments, surface water and associated uptake by biota utilizing the affected area. The monitoring program would be developed in order to allow for regulators to assess the migration of the contaminants from the wetlands and determine if remedial actions might be necessary in the future. The monitoring program would take place on a yearly basis with a risk evaluation conducted within 5 years to determine the effectiveness of this approach.

2.9.1.2 Overall Protection of Human Health and the Environment

The no action alternative does not eliminate any exposure pathways or reduce the level of risk of the existing wetland sediment contamination.

2.9.1.3 Compliance with ARARs

This alternative does not achieve the RAOs or chemical-specific ARARs established for wetland sediment. Location- and action-specific ARARs do not apply to this alternative since further remedial actions will not be conducted.

Table 2-19

Summary of Wetland Sediment Alternatives Evaluation

Remedial Alternative	Threshold Criteria		Balancing Criteria					
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability		Cost Approx. Total Present Worth
						Technical/Engineering Considerations	Estimated Time for Implementation (years)	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	$100,247
2 -- Capping w/Clean Fill and Off-Site Creation of Wetlands	Potentially eliminates multiple exposure pathways to ecological receptors. Organisms utilizing portions of the wetlands below the surface may potentially continue to be exposed.	Does not meet ARARS for protection of wetlands.	Will reduce or eliminate viable exposure pathways and prevent degradation of adjacent wetlands No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the Site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during Site activities. Grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain and wetlands.	<1	$611,762
3 A -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Clean Fill	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity, and volume is achieved through removal, not treatment.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None	<1	$780,071
3 B -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Biosolid Compost	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity,and volume is achieved through removal, not treatment. Additionally, use of biosolid compost reduces toxicity by limiting bioavailability of contaminants.	Level C and D protective equipment required during Site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None.	<1	$699,548

2.9.1.4 Long-Term Effectiveness and Permanence

The remediation goals derived for protection of ecological receptors would not be met. Because contaminated wetland sediment remains under this alternative, a review/reassessment of the conditions at the Site would be performed at 5-year intervals to ensure that the remedy does not become a greater risk to human health and the environment.

2.9.1.5 Reduction of M/T/V Through Treatment

No reductions in contaminants M/T/V are realized under this alternative.

2.9.1.6 Short-Term Effectiveness

Since no further remedial action would be implemented at this Site, this alternative poses no short-term risks to onsite workers. It is assumed that Level D personnel protection would be used when sampling various media.

2.9.1.7 Implementability

This alternative could be implemented immediately since monitoring equipment is readily available and procedures are in place.

2.9.1.8 Cost

Minimal costs are associated with this alternative relative to other remedial action alternatives. No capital costs are associated with this alternative. The estimated O&M cost is approximately $100,247.

2.9.2 Alternative W-2 – Capping with Clean Fill and Off-Site Creation of Wetlands

2.9.2.1 Description

Capping the contaminated sediment in the wetlands at the RM Site would serve to prevent rainfall infiltration and future leaching into the groundwater. In addition, capping also would limit direct contact exposure to contaminated media under the cap. Varying degrees of capping can be implemented depending on the severity of contaminants in the area. Caps can range from a simple natural soil cap to a multilayer soil/synthetic cap. For the wetlands, a foot of topsoil would be placed on the surface of the contaminated wetland sediment and graded evenly. Capping with a minimum of one foot of clean fill would be required to eliminate multiple exposure pathways as identified in the ecological risk assessment. The cap would be applied to the approximately 5.7 acres of wetlands containing sediment with lead concentrations greater than 800 mg/kg. Because this action results in a destruction of the wetlands by altering the grade and hydrology of the system, off-Site creation of wetlands is required to compensate for the loss.

Alternative W-2 would eliminate direct contact with contaminated media, minimize contaminant migration to groundwater, and eliminate contaminant migration. Land use restrictions and security fencing may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

2.9.2.2 Overall Protection of Human Health and the Environment

This alternative will not remove or contain the contaminated sediments but potentially limits multiple exposure pathways to ecological receptors. Organisms utilizing portions of the wetlands below the surface may potentially continue to be exposed. The volume and concentration in the wetland will not be altered. Lead and other metals in the wetland sediment may continue to result in adverse impacts.

2.9.2.3 Compliance with ARARs

The RCRA hazardous waste disposal facility requirements are potentially applicable. The RM Site is located in a 100-year floodplain within a zone designated as A3, indicating that base flood elevations and flood hazard factors have been determined for this area. The ARAR (40 CFR 264) requires that disposal facilities be designed to withstand a 100-year flood. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

Regarding construction activities related to implementing the alternative, 40 CFR 6 Appendix A requires that EPA-controlled structures and facilities must be constructed in accordance with existing criteria and standards set forth under the NFIP and must include mitigation of adverse impacts wherever feasible, including the use of accepted floodproofing and/or other flood protection measures. To achieve flood protection, EPA shall wherever practicable, elevate structures above the base flood level rather than filling land. In addition, the capped area may be classified as a Tennessee SWPD Class II disposal facility. If so, the substantive requirements of the SWPD rule regarding Class II disposal facilities (e.g., siting) would apply to the Site. The SWPD rule (Rule 1200-1-7) and the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257) require that disposal facilities must not be located in a 100-year floodplain, unless both of the following can be demonstrated:

- Location in the floodplain will not restrict the flow of the 100-year flood nor reduce the temporary water storage capacity of the floodplain; and
- The facility is designed, constructed, operated, and maintained to prevent washout of any solid waste.

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. With appropriate stormwater runon and runoff controls, the substantive requirements of this ARAR are expected to be met. In addition, the off-Site creation of wetlands component of this alternative to compensate for the loss of forested and scrub/shrub wetlands is expected to meet the wetlands mitigation requirements of CWA Section 404. The SWPD rule requires that new landfills and lateral expansions shall not be located in a wetlands, unless the owner or operator can make the following demonstrations:

- the presumption of a practicable alternative that does not involve wetlands is clearly rebutted;
- the construction/operation of the landfill will not cause or contribute to violations of applicable State water quality standards, any applicable toxic effluent standard or prohibition under Section 307 of the CWA, and will not cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of endangered or threatened species;
- the landfill will not cause or contribute to significant degradation of wetlands;
- to the extent required under Section 404 of the CWA or Tennessee Water Pollution Control Act, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function); and
- sufficient information is available to make a reasonable determination with respect to these demonstrations.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.9.2.4 Long-Term Effectiveness and Permanence

Under this alternative, the cap would have to be maintained to ensure that it continues to perform as designed; consequently, long-term monitoring, inspection, and maintenance would be required. The cap would be susceptible to settlement, ponding of surface water, erosion, and disruption of cover integrity by deep-rooting vegetation and burrowing animals. The cover would need to be periodically inspected, and required maintenance would need to be implemented in order to maintain effectiveness.

The long-term effectiveness of capping the waste would be enhanced by selecting the proper cover design and grading layout. In addition, access restrictions such as land use controls and fencing would be required to prevent land uses incompatible with the Site; specifically, land uses that would compromise the cap should be precluded.

The remedial action objectives of reduction of exposure and prevention of transport and migration of Site contaminants, and prevention of degradation of adjacent wetlands will be achieved. However, the restoration of wetland communities and elimination of further degradation of the Site wetlands will not be achieved.

2.9.2.5 Reduction of M/T/V Through Treatment

This alternative will not remove or dispose of the contamination. Contaminated sediment will be left intact but the pathway of exposure will be reduced for multiple receptors. Toxicity may be reduced by limiting bioavailability. The volume of material at the Site will not be altered.

This alternative would not meet EPA's expectation to use treatment to address the principal threats posed by a site, although in some situations, containment of principal threats is warranted (EPA 1991). Based on sample results collected during previous Site investigations, 8,700 CY of sediment would be considered "principal-threat" waste.

Containment of principal threats may be warranted where treatment technologies are not technically feasible or available within a reasonable time frame; or where the volume of materials or complexity of the site makes implementation of treatment technologies infeasible; or where implementation of a treatment-based remedy would result in greater overall risk to human health and the environment or cause severe effects across environmental media. A review of currently available technologies and Site conditions does not suggest that these situations would apply to the RM Site.

2.9.2.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short term and minimal.

On-Site workers would be adequately protected from short-term risks by using appropriate personal protective equipment and by following proper operating and safety procedures.

The wetland system would be destroyed since application of the cap will alter grade and hydrology. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

2.9.2.7 Implementability

Construction of a soil cap is a standard construction practice and materials are readily available. Other than the capping of contaminated material in a floodplain and wetland, no significant construction issues are expected to be encountered.

Army Corps of Engineers (ACOE) permits are expected to be required. Advance consultation should occur while planning the action to ensure that all involved agencies are allowed to provide input.

All services and materials for this alternative are readily available.

2.9.2.8 Cost

The total present worth for Alternative W-2 is approximately $611,762. The estimated capital cost is approximately $541,601, and the estimated O&M cost is approximately $70,161.

2.9.3 Alternative W-3 – Excavation & Revegetation/Restoration of Wetlands Option A - Regrading With Clean Fill

2.9.3A.1 Description

Alternative W-3 involves the excavation of contaminated wetland sediments to a depth of one foot, and under Option A, replacing that material with clean soils. Excavated areas will be backfilled to the existing grade and revegetated according to the Wetlands Revegetation Plan developed for the RM Site wetlands (ERRT 1998). Maintenance plans to eliminate the intrusion of less desirable species and to promote success will be developed and Site monitoring would also be required. Excavated sediments would be stockpiled with contaminated surface soils and final disposition of the contaminated wetlands sediment would follow the remedial alternative selected for surface soils.

Depending on contaminated levels, excavated plant material would be consolidated with excavated sediment or mulched and disposed of separately. In excavating the approximately 5.7 acres of sediment with lead concentrations greater than 800 mg/kg to a depth of one foot; approximately 9,300 CY of contaminated sediment will be generated. Approximately 8,200 CY of the excavated sediment would be considered principal-threat waste and 1,100 CY would be considered low-level threat waste.

Treatability testing may be required to determine if pre-treatment (e.g. dewatering or stabilization) of the wetlands sediment would be required to decrease leachability of lead and improve handling characteristics of sediment prior to transport and disposal in order to implement this alternative. If pre-treatment is required, the development or selection of the process must consider the impact of the process on the wetlands community.

The revegetation of the wetlands is based on excavation of 5.7 acres where lead occurs above 800 mg/mg in sediment and which includes approximately 1.5 acres of forested and scrub/shrub wetlands. To compensate for the loss of forested and scrub/shrub wetlands; these areas will be replaced at a 2-to-1 creation-to-loss ratio. The revegetation of the wetlands is based on planting 3 acres of forested wetland and 9 acres of emergent wetlands. Forested mitigation areas would be seeded (3 lbs/acre) with a mixture of herbaceous plant species that do not form a turf and minimize competition with planted trees and shrubs. Trees and shrubs would each be planted at a density of 436 plants/acre. Emergent wetland areas would be seeded at a rate of 5 lbs/acre and planted with plugs or bare root plantings at a density of 4,840 plants/acre.

Deed restrictions may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

2.9.3A.2 Overall Protection of Human Health and the Environment

Source control of surface runoff and sediment transport will effectively eliminate a source of loading of contaminants to the adjacent wetlands. The removal of the contamination from the Site wetlands will effectively protect the environment. Removal will also reduce risk to ecological receptors.

The RAOs for reduction of risk to ecological receptors will be met and the alternative will restore the degraded wetlands' structure and function.

2.9.3A.3 Compliance with ARARs

EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. In addition, EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. The wetlands revegetation component of this alternative includes a 2-to-1 creation-to-loss ratio to compensate for the loss of forested and scrub/shrub wetlands which is expected to meet the wetlands mitigation requirements of CWA Section 404.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.9.3A.4 Long-Term Effectiveness and Permanence

This alternative provides source control and removal of contaminated sediments in the wetlands. This action would permanently remove contaminated sediments and thereby reduce risk to ecological receptors and improve water quality. The revegetation plan will restore the wetlands to a high functioning value which should support diverse ecological communities.

2.9.3A.5 Reduction of M/T/V Through Treatment

Mobility, toxicity, and volume of contaminants will be reduced through removal, not through treatment.

2.9.3A.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation; however, these potential, short-term impacts would be mitigated during the wetlands restoration phase. The revegetation plan uses plant species which should restore the system within one growing season, thereby limiting the impacts. Controls can be implemented to reduce impacts on adjacent wetlands.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Short-term impact on biological communities in the wetlands caused by excavation will be notable because of excavation of wetlands sediment. However, the goal of the wetland mitigation program is to replace lost wetland vegetation so that wetland function and values either will be present immediately following the completion of mitigation or will develop over time. In addition, a consideration of breeding seasons, and control of erosion and sedimentation in terms of scheduling activities should ease short-term impact.

2.9.3A.7 Implementability

All services and materials for this alternative are readily available. Moderate difficulty is posed by conducting operations in unstable sediment substrate. To avoid problems, excavation can be limited to dry periods. Revegetation will be performed in the spring and will require one month for completion.

2.9.3A.8 Cost

The total present worth cost for Alternative W-3, Option A is approximately $780,071. The estimated capital cost is $700,901. The estimated annual O&M cost is approximately $79,170.

2.9.3B Alternative W-3 – Excavation & Revegetation/Restoration of Wetlands Option B -- Regrading with Biosolid Compost Material

2.9.3B.1 Description

Option B is similar to Option A except that excavated areas would be backfilled with a biosolid compost material rather than clean fill. The compost would serve as the fill material, a metal-binding material and as a source of fertilizer to encourage revegetation/restoration. The compost material may also serve to bind contaminated groundwater should it percolate through the wetland. As with previous alternatives, a Site monitoring program would be implemented.

As is the case for Option A, excavated sediments would be stockpiled with contaminated surface soils and final disposition of the contaminated wetlands sediment would follow the remedial alternative selected for surface soils. In excavating the approximately 5.7 acres of sediment with lead concentrations greater than 800 mg/kg to a depth of one foot; approximately 9,300 CY of contaminated sediment will be generated. Approximately 8,200 CY of the excavated sediment would be considered principal-threat waste and 1,100 CY would be considered low-level threat waste.

Treatability testing may be required to determine if pre-treatment (e.g. dewatering or stabilization) of the wetlands sediment would be required to decrease leachability of lead and improve handling characteristics of sediment prior to transport and disposal in order to implement this alternative as well as to confirm the value of using a biosolid backfill. If pre-treatment is required, the development or selection of the process must consider the impact of the process on the wetlands community.

Excavated areas will be backfilled to the existing grade and revegetated according to the Wetlands Revegetation Plan developed for the RM Site wetlands (ERRT 1998). Maintenance plans to eliminate the intrusion of less desirable species and to promote success will be developed and Site monitoring would also be required. The revegetation of the wetlands is based on excavation of 5.7 acres where lead occurs above 800 mg/mg in sediment and which includes approximately 1.5 acres of forested and scrub/shrub wetlands. To compensate for the loss of forested and scrub/shrub wetlands; these areas will be replaced at a 2-to-1 creation-to-loss ratio. The revegetation of the wetlands is based on planting 3 acres of forested wetland and 9 acres of emergent wetlands. Forested mitigation areas would be seeded (3 lbs/acre) with a mixture of herbaceous plant species that do not form a turf and minimize competition with planted trees and shrubs. Trees and shrubs would each be planted at a density of 436 plants/acre. Emergent wetland areas would be seeded at a rate of 5 lbs/acre and planted with plugs or bare root plantings at a density of 4,840 plants/acre.

Land use restrictions and security fencing may be placed on the Site while the remedial action takes place. Monitoring would be required to assess the effectiveness of the remedial action.

2.9.3B.2 Overall Protection of Human Health and the Environment

Source control of surface runoff and sediment transport will effectively eliminate a source of loading of contaminants to the adjacent wetlands. The removal of the contamination from the Site wetlands will effectively protect the environment. Removal will also reduce risk to ecological receptors.

The RAOs for reduction of risk to ecological receptors will be met and the alternative will restore the degraded wetlands' structure and function.

2.9.3B.3 Compliance with ARARs

EPA's regulations (40 CFR Part 6, Appendix A) for implementing Executive Order 11988 (Floodplains Management) requires federal agencies to avoid or minimize adverse impacts of Federal actions upon floodplains, and to preserve and enhance the natural values of floodplains. Specifically, when it is apparent that a proposed or potential Agency action is likely to impact a floodplain or wetlands, the public should be informed through appropriate public notice processes. Furthermore, if a proposed action is located in or affects a floodplain or wetlands, a floodplain/wetlands assessment shall be undertaken, and a statement of findings explaining why the proposed action must be located in or affect the floodplain or wetlands.

The Protection of Wetlands Order (40 CFR 6) requires that no adverse impacts to wetlands result from a remedial action. The wetlands revegetation component of this alternative includes a 2-to-1 creation-to-loss ratio to compensate for the loss of forested and scrub/shrub wetlands which is expected to meet the wetlands mitigation requirements of CWA Section 404.

The substantive requirements for stormwater discharges during construction activities as outlined by the CWA are relevant and appropriate. However, a specific NPDES permit is not required for this remedial action.

All action-specific ARARs are expected to be met. The TAPCR dust suppression and control requirements (Rule 1200-3-8) apply to earth-moving activities associated with this alternative. ARARs for the control of fugitive dust emissions would be met by applying water to roads receiving heavy vehicular traffic and to excavation areas, as necessary.

2.9.3B.4 Long-Term Effectiveness and Permanence

This alternative provides source control and removal of contaminated sediments in the wetlands. This action would permanently remove contaminated sediments and thereby reduce risk to ecological receptors and improve water quality. The revegetation plan will restore the wetlands to a high functioning value which should support diverse ecological communities.

2.9.3B.5 Reduction of M/T/V Through Treatment

Mobility, toxicity, and volume of contaminants will be reduced through removal, not through treatment.

2.9.3B.6 Short-Term Effectiveness

The construction phase of this alternative would likely be accomplished within one field season; therefore, impacts associated with construction would likely be short-term and minimal. Short-term impacts are associated with excavation; however, these potential, short-term impacts would be mitigated during the wetlands restoration phase. The revegetation plan uses plant species which should restore the system within one growing season, thereby limiting the impacts. Controls can be implemented to reduce impacts on adjacent wetlands.

On-Site workers would be adequately protected by using appropriate personal protective equipment and by following proper operating and safety procedures. However, short-term air quality impacts to the surrounding environment may occur during waste consolidation and grading. Dust emissions would be monitored at the property boundaries. Fugitive dust emissions would be controlled by applying water to surfaces receiving heavy vehicular traffic or in excavation areas, as needed. A measurable, short-term impact to the surrounding area would include increased vehicular traffic and associated safety hazards, potential dust generation, and noise.

Short-term impact on biological communities in the wetlands caused by excavation will be notable because of excavation of wetlands sediment. However, the goal of the wetland mitigation program is to replace lost wetland vegetation so that wetland function and values either will be present immediately following the completion of mitigation or will develop over time. In addition, a consideration of breeding seasons, and control of erosion and sedimentation in terms of scheduling activities should ease short-term impact.

2.9.3B.7 Implementability

The use of biosolid compost material to address metals contamination is an emerging technology with limited full scale application. However, all services and materials for this alternative should be readily available.

2.9.3B.8 Cost

The total present worth cost for Alternative W-3, Option B is approximately $699,548. The estimated capital cost is $620,379. The estimated annual O&M cost is approximately $79,170.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis of the surface soil/sediment and groundwater alternatives based on the threshold and balancing evaluation criteria. The objective of this section is to compare and contrast the alternatives.

The alternatives are presented here to give decision makers a range of potential actions that could be taken to remediate this Site. These actions include:

Soil	No Action (Alternative S-1) Capping (Alternatives S-2, S-3, S-4, and S-6) Solidification/Stabilization (Alternatives S-5 and S-6)
Wetland Sediment	No Action (Alternative W-1) Capping and Off-site Creation of Wetlands (Alternative W-2) Excavation, Regrading and Wetlands Revegetation/Restoration (Alternative W-3)

Tables 2-20 through 2-21 present a summary of each remedial alternative along with ranking scores

Table 2-20
Comparative Analysis of Soil Alternatives
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Criteria Rating [1]						Approximate Present Worth ($)
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability	
S-1 -- No Action	0	0	0	0	5	5	$100,247
S-2 -- Capping	4	4	2	3	4	3	Opt.1-$1,735,804 Opt.2-$1,712,412
S-3 -- Capping With Pavement In Place	4	4	3	3	4	3	Opt.1-$1,453,803 Opt.2-$1,430,411
S-4 -- Capping With Construction of Above-Ground Disposal Cell	4	4	3	3	4	3	Opt.1-$1,506,847 Opt.2-$1,481,865
S-5A -- Excavation and Onsite Treatment With S/ S and onsite Disposal	5	4	4	5	4	3	Opt.1-$4,907,274 Opt.2-$4,244,992
S-5B -- Excavation and Onsite Treatment With S/S and offsite Disposal	5	5	5	5	4	4	Opt.1-$7,477,199 Opt.2-$6,181,160
S-6A -- Capping With Excavation & Onsite Treatment of Princ. Thrt Waste & onsite disposal	5	4	4	5	4	3	Opt.1-$3,175,137 Opt.2-$2,729,543
S-6B -- Capping With Excavation & Onsite Treatment and Offsite Disposal of Principal Threat Waste	5	4	4	5	4	3	Opt.1-$4,936,044 Opt.2-$4,013,508

[1]A ranking of “0" indicates noncompliance, while a ranking of “5" indicates complete compliance. Opt. 1 includes excavated wetland sediment; Opt. 2 does not.

Table 2-21

Comparative Analysis of Wetland Sediment Alternatives
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Criteria Rating [1]						Approximate Present Worth ($)
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability	
W-1 -- No Action	0	0	0	0	5	5	$100,247
W-2 -- Capping with Off-site Creation of Wetlands	3	2	2	3	3	4	$611,762
W-3 A -- Excavation, Regrading with Clean Fill and Wetlands Revegetation/ Restoration	5	5	5	4	4	4	$780,071
W-3 B -- Excavation, Regrading with Biosolid Compost Material and Wetlands Revegetation/ Restoration	5	5	5	5	4	3	$699,548

[1]A ranking of “0" indicates noncompliance, while a ranking of “5" indicates complete compliance.

for each evaluation criterion. Each alternative's performance against the criteria (except for present worth) was ranked on a scale of 0 to 5, with 0 indicating that none of the criterion's requirements were met and 5 indicating all of the requirements were met. The ranking scores are not intended to be quantitative or additive, rather they are only summary indicators of each alternative's performance against the CERCLA evaluation criteria. The ranking scores combined with the present worth costs provide the basis for comparison among alternatives.

For soil, Alternatives S-2 through S-7 all rank higher than Alternative S-1 in overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, and reduction of M/T/V. The three capping alternatives, Alternatives S-2, S-3, and S-4, are ranked similarly with the exception that Alternative S-2 ranks lowest in long-term effectiveness and permanence. The two treatment alternatives receive similar ranking in all criteria with the exception Option B of Alternative S-5 ranks highest in compliance with ARARs long-term effectiveness and permanence, and implementability. A comparison of the capping alternatives to the treatment alternatives indicates that the treatment alternatives (Alternatives S-5 and S-6) rank slightly higher than the capping alternatives (Alternatives S-2, S-3, and S-4) in overall protection of human health and the environment and reduction of M/T/V, but are more costly.

For wetland sediment, both Alternatives W-2 and W-3 rank higher than Alternative W-1 in overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, and reduction of M/T/V. Both options under Alternative W-3 (Excavation, Regrading and Wetlands Revegetation) rank higher than Alternative W-2 (Capping and Off-Site Creation of Wetlands) in overall protection of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, and reduction of M/T/V.

EPA and the Tennessee Department of Environment and Conservation (TDEC) have cooperated throughout the RI/FS process. The State has participated in the development of the RI/FS and Proposed Plan by providing comments on planning and decision documents. EPA and TDEC are in agreement with the selected alternatives S-5B and W-3B. Please refer to the Responsiveness Summary which contains a letter of concurrence from TDEC.

EPA received several letters from residents in the Town of Rossville which supported the selected remedy proposed by EPA. During the public meeting on November 30, 1998, town residents and local government officials expressed interest and support for the selected remedy presented by EPA. Please see the Responsiveness Summary which contains these letters and a transcript of the public meeting.

2.11 SELECTED REMEDY

The EPA Selected Remedy is Source Materials Alternative S-5B and Wetlands Alternative W-3B. Based upon current information, this remedy appears to provide the best balance among the nine criteria that EPA uses to evaluate alternatives. EPA has determined that the Selected Remedy would be protective of human health and the environment; would attain the Site goals; comply with ARARs; and would be cost effective.

The Selected Remedy shall include the following:

- Demolition of most of the on-Site pavement and buildings. The main office building and the pavement immediately surrounding this building will remain on Site. The building debris, pavement, and equipment will be decontaminated by steam cleaning. The decontaminated metal debris will be taken off Site to a metal recycling facility. The equipment will be sold or donated to interested parties. All other debris will be taken off Site to a permitted disposal facility;

- Excavation of contaminated soil, landfilled slag, and contaminated wetlands sediment that exceed their corresponding cleanup standard;

- On-Site excavation areas shall be backfilled and restored to the existing grade or better. The backfill source, biosolids, may require treatability testing to confirm the value of using biosolid as a backfill;

- Stabilization/solidification/fixation of contaminated soil, stockpiled slag, landfilled slag, and wetlands sediment;

- Off-Site disposal of soils, slag, and sediment to a RCRA-disposal facility;

- Application of a layer of biosolids to the entire Ross Metals Site. Grass seeding of the facility and landfill areas; and revegetation of the Site wetlands according to the Wetlands Revegetation Plan developed by EPA, 1998.

- Development of maintenance and monitoring plan to assess the effectiveness of the cleanup action.

The total estimated construction costs associated with both alternatives are $ 7,390,687. The estimated Operations and Maintenance costs are $30,045. The estimated total present worth costs are $ 7,420,732.

Performance Standards

Demolition of most of the on-Site pavement and buildings. The main office building and the pavement immediately surrounding this building will remain on Site. Appropriate testing and any necessary decontamination of the main office building shall be performed. EPA shall have a reasonable opportunity to review and comment on the proposed sampling and decontamination program prior to implementation. The building debris, pavement, and equipment will be decontaminated by steam cleaning. The decontaminated metal debris will be taken off Site to a metal recycling facility. The equipment will be sold or donated to interested parties. All other debris will be taken off Site to a nonhazardous disposal facility.

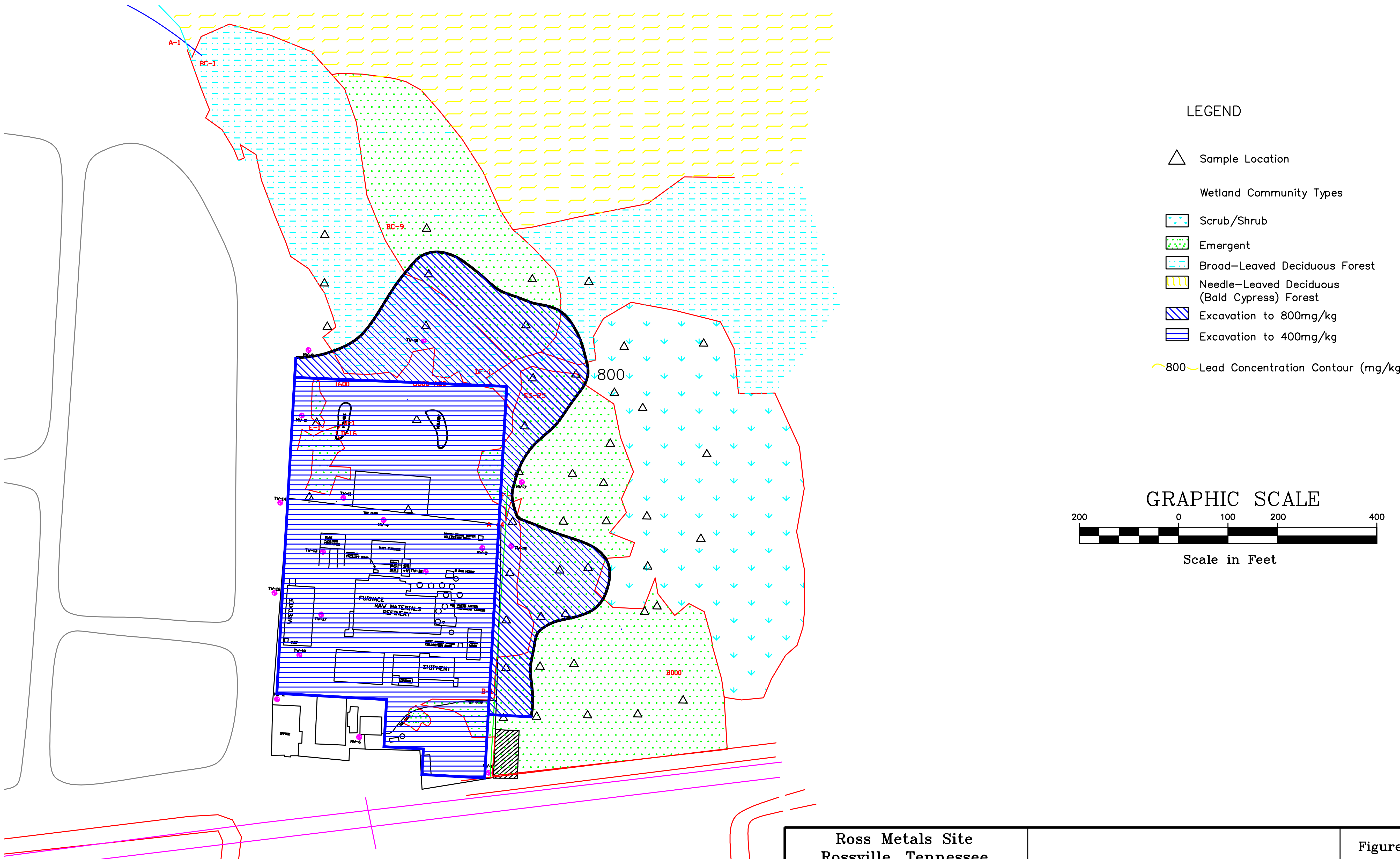
Soil/sediment with constituent concentrations greater than the excavation levels listed in **Table 2-22** shall be excavated and disposed in an off-Site RCRA-permitted non-hazardous waste landfill. **Figure 2-30** provides a map delineating the approximated areas where soil/sediment will be excavated based upon data obtained during the RI field investigations. An estimated 33,674 cubic yards of soil/sediment exceed the excavation standards. An estimated 16,000 cubic yards of slag exceed the excavation standards. Approximately 1,000 cubic yards of lead-contaminated buildings constitute a safety hazard. An estimated 3,700 cubic yards of demolition debris will be generated as a result of the remediation activities, of which approximately 1,500 tons of metal debris/equipment will be available for metal recycling.

Prior to excavation activities, a statistically-based sampling program shall be implemented within the areas slated for removal to further define those soils which exceed the applicable excavation standards. EPA shall have a reasonable opportunity to review and comment on the proposed statistical sampling program prior to implementation. Results of this sampling program shall be reviewed and approved by EPA prior to excavation activities.

All excavation activities shall be conducted in a manner which provides adequate short-term protection of on-Site workers, and minimizes disruptions to local businesses and adjacent residents. Air monitoring during active excavation shall be implemented for the protection of on-Site workers and to assess potential off-Site impacts. As warranted, dust and odor control measures shall be instituted to mitigate adverse impacts in the active excavation areas, haul roads and adjacent off-Site areas. An excavation confirmation sampling program shall be developed to verify that all soil, sediment, and slag have been removed to the specified excavation standards. EPA shall have reasonable opportunity to review the statistical methods employed by this confirmational sampling

Table 2-22 Excavation Standards	
Contaminant of Concern	**Excavation Standard**
Surface Soil (mg/kg)	
Aluminum	11,620
Antimony	3
Arsenic	5
Barium	505
Cadmium	7
Copper	293
Iron	16,100
Lead	400
Manganese	559
Selenium	37
Vanadium	51
Subsurface Soil (mg/kg)	
Lead	400*
Wetlands Sediment (mg/kg)	
Aluminum	8,860
Antimony	28.4 - 104
Arsenic	5.58
Cadmium	0.37 - 3.73
Copper	22.4 - 101.5
Lead	800
Mercury	ND - 0.21
Nickel	9.10
Slag	Since the blast slag waste has unique characteristics that make it easily identifiable, removal of the landfill area slag and stockpiled slag will be verified by visual inspection and approved by EPA or its representative.

ND - Not Detected
* - Modeling conducted during Remedial Design may indicate a less conservative clean-up goal is sufficient for protection of groundwater.



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Ross Metals Site Rossville, Tennessee	Excavation Contours	Figure No. 2-30
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		3-99

program prior to excavation activities.

On-Site excavation shall be backfilled and restored to a condition consistent with the intended future use of the property. The backfill source must be prequalified to document its quality. Treatability testing may be required to confirm the value of using a biosolid as a backfill.

The wetlands will be revegetated according to the Wetlands Revegetation Plan (ERRT 1998). The facility area and landfill area (approximately 8 acres) will be grass seeded. Maintenance plans to eliminate the intrusion of less desirable species and to promote success shall be developed and Site monitoring will be required.

Excavated material may be stockpiled on-Site prior to off-Site transportation. All excavated material shall be transported off-Site for disposal in an approved RCRA-permitted landfill. All transportation and off-Site disposal activities shall be conducted in full accordance with all ARARs, including but not limited to, RCRA regulations. Per the requirements of Phase IV Land Disposal Restrictions (LDRs) - waste, soil, and debris classified as hazardous must be treated to Universal Treatment Standards (UTS) prior to land disposal. Treatment of these materials shall use solidification/stabilization/fixation to achieve UTS.

Summary of Estimated Remedy Costs

Table 2-23 provides a cost estimate for implementing the selected remedy.

Expected Outcomes of the Selected Remedy

The purpose of this response action is to eliminate and reduce risks posed by ingestion, inhalation, or direct contact with soil/sediment/slag/buildings; minimize migration of contaminants to

Table 2-23
Capital Costs for Selected Remedy

Discount Rate: 7%

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE DOLLARS	TOTAL COSTS DOLLARS
MOBILIZATION/DEMOBILIZATION	each	1	$80,000	$80,000
SITE DECONTAMINATION/DEMOLITION				
Building Demolition	cf	27,000	$0.23	$6,210
Concrete/Asphalt Demolition	sy	21,333	$10.37	$221,223
Building Demolition	sf	126,000	$0.75	$94,500
Pavement Demolition	sf	192,000	$0.85	$163,200
Recycling Metal Debris				-$45,000
loading and transportation	ton	1,500	$20	
payment from recycling	ton	1,500	$50	
Equipment	lump sum	1	$25,000	$25,000
EXCAVATION				
Soil and Sediment Excavation (9,300+13,125+8,750+2,500)	cy	33,675	$5	$168,375
Dust Control & Placement in Staging Areas (2 water trucks- each @$3,500/month)	month	3	$7,000	$21,000
Excavation of Landfilled Slag	cy	10,000	$2	$20,000
Excavation Monitoring	sample	45	$500	$22,500
ON-SITE TREATMENT				
Treatability Study	lump sum	1	$50,000	$50,000
Treatment (33,675 CYx1.5 + 16,000 CY x 2)	ton	82,513	30	$2,475,375
Treatment System Monitoring	sample	50	$500	$25,000
Off-Site Disposal of Non-hazardous Material (Assume 5% increase)	ton	86,639	$30,000	$2,599,160
Backfill Landfill and sub-surface areas w/Clean Fill (10,000+8,750+2,500)	cy	22,250	$10	$222,500
Installation of Biosolids Throughout Site	acres	14	$12,000	$168,000
Installation of Vegetative Cover on Facility Area	acre	8	$2,000	$16,000
Plant Emergent Forested Area	acre	3	$3,500	$10,500
Plant Forested Wetland Area	acre	3	$5,500	$16,500
EQUIPMENT & MATERIALS				
Erosion Control	sy	500	$2.14	$1,070
Health and Safety Equipment (30 people @ $60/person/day)	day	90	$1,800	$162,000
Subtotal - Capital Cost				**$6,523,113**
Engineering & Administrative (3% of Capital Cost)				$196,693
Subtotal				$6,718,806
Contingency (10% of Subtotal)				$671,881
Total Construction Cost				**$7,390,687**
Present Worth O&M Cost				$30,045
Total Present Worth				**$7,420,732**

Table 2-24 **Operation and Maintenance Costs for Selected Remedy**						
ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE DOLLARS	TOTAL ANNUAL COST, DOLLARS	OPERATION TIME, YEARS	PRESENT WORTH
Wetlands and Lawn Inspection	inspection	2/yr	$500	$1,000	5	$4,100
Wetlands and Lawn Maintenance Mowing: 8 Ac x 43,560 SF;	1,000 SF	5/yr	$1.78	3,101	5	12,714
Fertilizing: 14 Ac x 43,560 SF	1,000 SF	2/yr	$2.10	2,561	5	10,500
Subtotal				$5,662		$27,314
Contingency (10% of Subtotal)				$566		$2,731
Total				$6,228		$30,045

groundwater; restore impacted wetland communities and prevent further degradation of the adjacent wetlands. The remedy shall address all soils contaminated with contaminants of concern in excess of their corresponding risk-based cleanup level. Since no Federal or State ARARs exist for soil/sediment, the action levels were determined through a Site-specific risk analysis. Remediation activities shall be monitored to ensure that clean-up levels are achieved. The Site is expected to be available for industrial/residential/recreational land use as a result of the remedy.

2.12 STATUTORY DETERMINATIONS

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

2.12.1 Overall Protection of Human Health and the Environment

EPA's Selected Remedy protects human health and the environment through the excavation and immobilization of lead-contaminated media followed by off-Site disposal.

Cancer risks, non-cancer risks and lead exposure to human receptors for future use at the Site will be eliminated. The exposure levels will be reduced to within EPA's acceptable risk range of 10-4 to 10-6 for carcinogens; below the HI of 1 for noncarcinogens; and below EPA's acceptable blood lead level of 10 ug per deciliter for lead. Protection of human health will be achieved by excavating, treating, and shipping off-Site the soils, sediments, and wastes which pose future risks to a lifetime resident, child resident, adult resident, and site worker.

Acute and chronic risks to ecological receptors are mitigated. The exposure levels will reduced below the HI of 1 for noncarcinogens.

2.12.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy shall be in compliance with all Federal ARARs and any more stringent State ARARs. It is important to note that the Selected Remedy is the only practicable alternative outside the floodplain.. Executive Order 11988 - Floodplain Management emphasizes the importance of evaluating alternatives to avoid effects and incompatible development in the floodplains; and those alternatives located in the floodplain may not be selected unless a determination is made that no practicable alternatives exist outside the floodplain. The Selected Remedy is considered a practicable alternative outside the floodplain. The selection of any other alternative would require a floodplains assessment and following methods to minimize potential harm to the floodplain.

The following ARARs will be attained by the selected remedy:

Action-Specific:

- RCRA requirements for identification, management and transportation of hazardous waste (40 CFR 261, 262 and 263).

- RCRA requirements pertaining to the land disposal of particular hazardous wastes (40 CFR 268).

- Clean Water Act exceptional quality sludge criteria (40 CFR 503) for regulating sludge and sets criteria for the safe use of sludge-derived products.

Location-Specific:

- Protection of Wetlands and Floodplains are EPA regulations for implementing Executive Orders 11988 and 11990 (40 CFR Part 6, Appendix A).

- RCRA requirements for hazardous waste facility locations (40 CFR 264).

- Regulations Governing Solid Waste Processing and Disposal in Tennessee, Chapter 1200-1-7 establishes specific requirements for the operation and maintenance of solid waste landfill disposal sites.

- Tennessee Air Pollution Control Act, Chapter 1200-3-6 and 1200-3-8 sets nonprocess emission standards and regulates fugitive dust emissions.

Other Criteria, Advisories, or Guidance To Be Considered (TBCs):

- Floodplain Management Executive Order 11988 for avoiding adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.

- Wetlands Management Executive Order 11990 for minimizing the destruction, loss or degradation of wetlands.

- Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd Edition, latest update, Chapter 9.

- Methods for Evaluating the Attainment of Cleanup Standards Volume 1: Soils and Solid Media, U.S. EPA.

- Guidance for Hazardous Waste Site Investigation, EPA QA/G-4HW.

2.12.3 Cost-Effectiveness

EPA's Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (40 CFR 300.430(f)(1)(ii)(D). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represent a reasonable value for the money to be spent.

For this Site, Alternative S-1 is not cost-effective because it would not result in any reduction of the toxicity, mobility, or volume of wastes nor would it be effective in the long-term at reducing site risks in a permanent manner. Alternatives S-2, S-3, and S-4 were not considered to be cost-effective as they would not result in treatment of principal threat waste and reduction of toxicity and volume is not realized. Alternatives S-5A/B and S-6A/B were determined to be cost-effective. In evaluating the incremental cost-effectiveness of these alternatives, the decisive factors considered were the time frame required to construct the remedy, the time frame in which the remedial goals will be achieved, long-term effectiveness and compliance with ARARs. EPA believes that the additional money required to implement Alternatives S-5B merits the overall effectiveness of the remedy and represents the best value for the money to be spent.

2.12.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for this Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering State and community preference.

The Selected Remedy treats the principal threats posed by the Site, achieving significant reductions in toxicity and mobility. Off-Site disposal will not require extensive monitoring, inspection, or maintenance for the Site as compared to the other on-Site disposal alternatives. The other alternatives considered would all require long-term monitoring, inspection and maintenance. The capping alternatives would be susceptible to settlement, ponding of surface water, erosion and disruption of cover integrity. The Selected Remedy satisfies the criteria for long-term effectiveness by removing the source materials and stabilizing lead in contaminated media.

The Selected Remedy reduces toxicity, mobility, but not volume through treatment. There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. There are no special implementability issues that sets the Selected Remedy apart from any of the other alternatives evaluated. In fact, the administrative and technical issues associated with siting a landfill in a floodplain will make the other alternatives considered more difficult to implement than the Selected Remedy.

2.12.5 Preference for Treatment as a Principal Element

By treating the contaminated soils, sediment and slag through immobilization, the Selected Remedy addresses the principal threats posed by the Site. By utilizing treatment as a significant portion of the Remedy, the statutory preference for remedies that employ treatment as principal element is satisfied.

2.12.6 Five-Year Requirements

Because this remedy will not result in hazardous substances remaining on-Site above health-based levels, a five-year review will not be required for this remedial action.

3.0 RESPONSIVENESS SUMMARY

The U.S. Environmental Protection Agency (EPA) held a public comment period from November 18, 1998 to December 18, 1998. An extension to the public comment period was requested. As a result, it was extended to January 19, 1998. The public comment period was held for interested parties to comment on the Remedial Investigation/Feasibility Study (RI/FS) results and the Proposed Plan for the Ross Metals Superfund Site in Rossville, Tennessee.

The Proposed Plan included in Attachment A of this document, provides a summary of the Site's background information leading up to the public comment period.

EPA held a public meeting at 6:30 pm on November 30, 1998 at the Rossville Christian Academy, Rossville, Tennessee to outline the RI/FS and describe EPA's proposed remedial alternative for the Ross Metals Site. All comment received during the public comment period have been considered in the final selection of the remedial alternative.

3.1 RESPONSIVENESS SUMMARY OVERVIEW

During the public comment period, the Rossville community and local government officials expressed their support of the EPA Selected Remedy. Four letters by the community were received during the public comment period which supported the Selected Remedy. As evidenced in the November public meeting transcript, the community and local government officials expressed their support of the Selected Remedy during the meeting. Some of the major concerns expressed included the length of time it is taking to clean up the Ross Metals Site and the length of time it may take to negotiate with the PRPs to clean up the Site.

The PRPs submitted three different comment letters during the public comment period. In each of these submittals, the PRPs disagreed with EPA's Selected Remedy. The main objection to EPA's Selected Remedy is off-Site disposal.

3.2 SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED BY THE ROSSVILLE COMMUNITY

The public comments appear in bold text and the EPA response follows.

- **EPA's Preferred Alternative, nor any of the other options, address the removal of lead-contaminated sludge from Rossville Lagoon – Cell #1.**

Comment acknowledged. EPA reviewed the waste-water treatment plant records and found sampling results from Cell #1. It was determined by the State that the sludge in Cell #1 is non-hazardous. Lead results ranged from 10 - 245 ppm. EPA's soil cleanup numbers for the Ross Metals Site are 400 ppm and 800 ppm. Lead results from the sludge are below EPA cleanup numbers.

EPA is considering the use of sludge from Cell #1 for use as backfill at the Ross Metals Site. EPA will perform comprehensive sampling of Cell #1 to confirm the earlier lead results. Should the sludge pass appropriate lead and other criteria, EPA with the City of Rossville's permission, will use this material in the Superfund cleanup at Ross Metals. The City of Rossville would then be able to use Cell #1 in their waste-water treatment system as they deem necessary.

3.3 SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED BY THE "GROUP"

The Group's comments appear in bold text and the EPA response follows.

- **An RI consistent with EPA protocols (EPA/540/-G-89/004) was not conducted.**

- **EE/CA investigation did not generate data sufficient to support an adequate FS or the development of an RD.**

- **A pre-design investigation will be necessary as part of the RD stage to fill the data gaps.**

- **Existing data are not sufficient to estimate volumes of waste accurately**.

EPA disagrees with these comments. The EE/CA investigation focused on soils, slag and groundwater contamination. The EE/CA provided adequate data to support a decision for soils, slag, buildings and equipment. In addition to the EE/CA, a human health risk assessment, an ecological risk assessment which included additional soils/sediment characterization, a stabilization treatability study, a dewatering treatability study, and a biosolids treatability study were performed. The totality of this information has provided sufficient data and is consistent with the RI/FS process. As indicated in the RI/FS, additional information is needed to characterize groundwater. Volumes of waste have been accurately estimated. Graphics depicting the results of trenching operations during the November 1996 field work were inadvertently left out of the RI/FS. The graphics will be included in the next Administrative Record update. Pre-Design investigations are a routine part of the Remedial Design process.

- **The selected remedy is inconsistent with EPA policy, as defined in <u>Land Use in Superfund Remedy Selection</u>. Future development of the Site for residential purposes is prohibited because it is zoned light industrial. EPA should consider current zoning in the selection of remedial action levels**.

EPA does not agree with this comment. EPA has followed the Land Use Directive by considering the information presented below.

The Site is currently zoned as general industrial. The zoning specifically states that "this district is not intended to allow uses which may be considered hazardous because of the use of, or production of, toxic or highly flammable materials." It is important to note that Ross Metals, a secondary lead smelter, produced a hazardous waste and was located in this district.

The zoning does not prohibit residential development. The Site is currently located immediately adjacent to residences with children. The Site has used been for agriculture and a community park in the past.

The Town of Rossville has not been able to attract new industry in recent years and does not anticipate new growth patterns. The Site is also physically bound by it's surroundings and location - it is located in the 100-year floodplain, adjacent to wetlands, a waste-water treatment plant, residences, and a railroad.

EPA has had discussions with local land use authorities and community members regarding future land use for the Ross Metals Site. They have strongly expressed their desire for the Site to be used in the future for the community, e.g., a park. The Town of Rossville and Fayette County officials are interested in the Town of Rossville obtaining the Site property deed.

- **EPA's selection of a 400 ppm lead-in soil performance criterion for subsurface soil is not based on site-specific data and should instead be based upon additional studies, to be performed during the remedial design, that would determine whether 400 ppm lead leaches dissolved lead to groundwater above the action level for lead in groundwater.**

EPA acknowledges this comment and agrees that modeling conducted during the pre-design effort may indicate that a less conservative clean-up goal will be sufficient for protection of groundwater.

As indicated in the FS, a one-dimensional geochemical model was used to evaluate the migration of lead in soil beneath the smelter slag and the migration of lead below the contaminated soil near the wrecker building. The model suggested that the slag material is a potential source of contamination to groundwater. The model predicted that lead will migrate to groundwater in six years and the concentration of lead will exceed 15 ppb in 55 years. In addition, the geochemical model suggested that soils near the wrecker building are acting as a continuing source of contamination to groundwater and the lead concentration in groundwater will continue to increase unless the source is removed. Model output indicated that removal of lead to 100 ppm left a residual concentration of 3.71 ppm, which is near background levels, and predicts that a removal action level of 100 ppm would be protective of groundwater for at least 90 years. However, the conservative nature of this number, along with the uncertainty surrounding the modeling effort, make it inappropriate to use as a subsurface cleanup goal. The 100 ppm goal is based on the assumption of a 5,000 ppm surface load factor. However, the establishment of a 400 ppm risk-based surface soil clean-up goal would mean surface soil concentrations no greater than 400 ppm. With a surface soil concentration of 400 ppm and considering the nature of contamination, clean up of subsurface soils to 400 ppm in the area of the wrecker building and truck wash should allow for the protection of groundwater.

- **Have not determined conclusively whether there has been an impact to groundwater quality in the shallow aquifer resulting from the residual lead in soil or from the presence of residual slag.**

EPA agrees. Please see above comment regarding the slag and soils near the wrecker building. In addition, lead results in groundwater samples collected to date suggest that the Site has impacted groundwater quality. However, as the RI/FS indicates, recent results from MW5 do not confirm earlier (higher) sample results, and the high turbidity associated with unfiltered samples collected as the Site means the horizontal extent of contamination may be much less than the current data indicate. Further definition impact to groundwater will be completed as part of the Operable Unit No. 2 RI/FS.

- **No investigation to determine whether lead in wetlands is attributable to mobilization of dissolved lead in shallow groundwater and discharge into the wetland areas.**

EPA disagrees with this comment. As indicated in the RI/FS, primary mechanisms available for contaminant transport away from the Site are (1) transport by rainwater runoff, (2) rainwater infiltration to groundwater, and (3) windblown dust movement. Existing data in the wetlands clearly indicates the wetlands have been impacted by the Site contaminants. The Operable Unit No. 2 will provide data regarding to what extent, if any, groundwater contamination is migrating to the wetlands.

- **Remedial action objectives for surface soil containing lead and other metals should be based on exposure scenarios provided in the Risk Assessment Guidance for Superfund (EPA/540/1-89/002), and should be consistent with agency-approved cleanup goals at other secondary smelting Superfund sites in EPA Region 4, where a soil remedial action objective of 1,000 ppm has been selected (e.g., ILCO Superfund Site).**

The Risk Assessment was completed in accordance with the framework provided in the Risk Assessment Guidance for Superfund. The guidance does not provide specific site exposure scenarios to use in the completion of a site risk assessment. Cleanup goals at the Ross Metals Site are primarily a function of managing risk in consideration of site-specific characteristics, not other secondary lead smelting sites. Also note, that of the 22 sample results (within the fenced facility) illustrated on Figure 7-1 that are above 400 ppm, 18 are also above 1,000 ppm. Excavation areas and resulting volumes proposed for the various alternatives would not change because of the need to either create a sufficient excavation for on-Site disposal or adequate regrading/revegetation of the Site for off-Site disposal.

- **Selected remedy was not based on the regulatory provision that a remedial action can**

consist of any combination of treatment, remedial action, engineering and institutional controls.

EPA disagrees with this comment. In developing the alternatives, EPA considered a variety of technologies and process options. Please see RI/FS Section 9.0 and 10.0 which screens and evaluates technologies and process options; and develops the range of alternatives selected for the Ross Metals Site. Also, it is important to note that the Selected Remedy allows for stabilization, solidification, fixation, or composting processes. These processes may be used in any combination for the Site soils and waste to meet the land disposal regulations.

- **A floodplain assessment per OSWER Directive 9280.0-02 that requires EPA to assess the effects of proposed alternatives on floodplains and floodplain protection was not conducted as part of the EPA site investigations, nor was it considered in the FS.**

EPA acknowledges this comment. EPA believes the commenters have misunderstood the Floodplain Management Executive Order 1198. EPA's Selected Remedy will not be located in a floodplain and will therefore, not adversely effect the floodplain. An Assessment would have been necessary had the Agency chosen a remedy located in the floodplain.

- **Long-Term Effectiveness and Permanence - On-Site disposal alternative could be considered more effective because the Group will maintain specific control and management of the treated materials, whereas there would be no control for specific wastes at off-Site facilities.**

EPA disagrees with this comment. The Group proposes to maintain specific control of the treated materials by establishing a trust fund for the City to conduct O&M at the Site; yet the current status of the City's WWTP berm - as reported by the Group - has eroding banks. The Group's comment that they will maintain specific control and then the comment that they will create a trust fund for others to implement the long-term operation and maintenance activities is a contradiction. In addition, if the Group's assertion that the preferred alternative merely transfers risks from one Site to another, then the Group's alternate remedy leaves that risk on Site, and limits rather than increases the number of options the community has in redeveloping the Site. Finally, the off-Site disposal of wastes would occur at facilities where appropriate controls are in place.

- **Short-Term Effectiveness - The short-term risk of injury or fatality to workers and community members is significant for off-Site disposal alternatives. In addition, there is an increased exposure to residents to particulates, ozone, and carcinogenic compounds known to occur in diesel fuel exhaust.**

EPA disagrees with this comment. A Site-specific Health and Safety Plan will be required before implementation of the Remedial Action. There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. EPA has considered the costs for implementing dust control measures, erosion control, personal protection and off-Site disposal. Please see the cost estimates provided in RI/FS Appendix O.

- **In addition to transportation risks associated with the off-Site disposal of materials from the Site, concern exists about the future, potential long-term liabilities that would be incurred by those parties that agree to implement an off-Site disposal remedy that involves disposal of material at a facility operated and managed by an independent company**.

EPA acknowledges this comment. Pursuant to Section 107 of CERCLA, 42 U.S.C. § 9607, "any person who by contract, agreement or otherwise arranged for disposal or treatment ... " is liable as a potentially responsible party. However, mitigating factors are contemplated in Section 107 which provides certain defenses including:

1. Act of God,
2. Act of War, and
3. An act or omission of a third party whose act or omission occurs in connection with a contractual relationship.

It appears that the Group is concerned about acts or omissions of a third party (landfill operator) who takes over custody of the waste once it is shipped off Site. In order to establish the third defense, a party must establish that (a) he exercised due care with respect to the hazardous substances concerned, and (b) he took precautions against foreseeable acts or omissions of any such third party. The risks posed by the hazardous waste in question is substantially reduced because prior to disposal the waste will be treated on Site and thereafter will be in a non-hazardous state. The act of reducing the toxicity of the contaminants is indicative of the exercise of due care. Further, if the Group carefully selects an authorized RCRA landfill that has been in operation for a respectable period of time, this should help to establish that they took precautions against foreseeable acts or omissions of the landfill operator. Regardless, some long term potential liability exists whether the waste is transported off Site or remains on Site. Given the extra precautions that will be taken and the public perception factor, disposal of the waste off Site does not necessarily pose more risk.

- **Cost - EPA's costs in the FS for off-Site disposal might be substantially underestimated. The costs for off-Site disposal will increase proportionally to the volume of material requiring transportation and disposal. The on-Site containment alternative costs do not increase directly with volume.**

- **Several on-Site disposal remedies for source materials, each of which is equally or more protective that EPA's proposed remedy, could be implemented at a lower cost than EPA's proposed remedy.**

EPA acknowledges this comment. On-Site containment alternatives are equally affected by increase in volume of material requiring disposal. The size of required excavation, amount of materials handling, and height of the required cap are all affected by volume of material requiring disposal, and therefore all affect costs. In addition, the Group's alternate remedy would include pre-design costs related to implementing a cap in a floodplain, as well as costs associated with additional engineering considerations associated with capping in a floodplain; hydrogeologic investigations to site a landfill; and long-term operations and maintenance costs into infinity.

The RI/FS report indicates that while certain onsite disposal remedies may be as effective as the preferred alternative in overall protection of human health and the environment, and could be completed at lower cost, they are not as effective as the preferred alternative in achieving compliance with long-term effectiveness, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness. Cost effectiveness is not determined merely by cost. Cost effectiveness is the costs proportionality to its overall effectiveness. Although the Selected Remedy will cost more to implement, the decisive factors considered were the time frame to implement the remedy, the time frame in which the remedial goals will be achieved, long-term effectiveness and compliance with ARARs. The additional money required to implement the Selected Remedy merits the overall effectiveness of the remedy and represents the best value for the money to be spent.

- **State Acceptance - The State would accept the alternate remedy (on Site with provisions).**

- **TDEC was prepared to approve Ross Metals request to construct an on-Site landfill while the facility was in operation.**

EPA disagrees with this comment. The commenters apparently missed portions of State and EPA records. Ross Metals was issued a Notice of Violation for the existing disposal site on June 16, 1986. The Notice of Violation required Ross Metals to either register the Site or to close it. The facility's landfill predated RCRA Subtitle D and was therefore not subjected to its current requirements. Ross Metals chose to apply for a permit and submitted an application. As was the practice at that time, TDEC's Division Geologist conducted a preliminary Hydrogeologic Review of the Site and determined that the Site may have been suitable for a landfill. On December 20, 1988, Paul Patterson of the Memphis DSWM Office notified Ross Metals that the review of their landfill application would be suspended until the status of the slag could be determined. They filed a RCRA Part B Permit Application November 8, 1988. The Permit was never approved.

EPA disagrees with the Commenter's assertion that the State would accept the alternative remedy with provisions. As evidenced by the State's letter of concurrence, the State concurred with EPA's selected remedy. The letter is included in Appendix B.

- **The scoring approach described in the FS was used to compare the Alternative Remedial Action (ARA) and EPA's preferred remedial alternative selected in the Proposed Plan. Based on the scoring, consistent with the NCP evaluation criteria, the ARA scores higher than or equal to EPA's preferred remedial alternative for each threshold and primary balancing criterion. As a result and consistent with the NCP, on-Site placement of the treated material is the preferred remedy, which is also consistent with EPA's EE/CA, conducted in December 1997.**

EPA disagrees with this comment. Soil Alternative 6A, as presented in the FS, is the most similar to the Group's alternative remedy, with the exception of the end use of the Site. S-6A was ranked lower than the Preferred Alternative in the areas of compliance with ARARs, long-term effectiveness and permanence, and implementability. There is greater difficulty for S-6A because of capping in a floodplain. Additional ARAR requirements would need to be implemented if construction occurred in a floodplain and siting a landfill occurred. Also, there is additional risk of leaving untreated material (low-level threat waste) on Site.

The EE/CA did not include a developed analysis of the ARAR requirements as compared to the FS. The EE/CA did not include the ecological data, treatability studies, a baseline human health risk assessment, or an ecological risk assessment. The EE/CA did not include the nine-criteria analysis as required by the NCP. The EE/CA combined with the additional studies, ARAR analysis, and nine-criteria analysis were used in the RI/FS report. The fact that the EE/CA selected remedy differs from the RI/FS selected remedy is a function of the more complete assessment that the RI/FS process requires as compared to the EE/CA process. It was during the EE/CA report preparation that the potential for selecting off-Site disposal as part of the RI/FS process became apparent. EPA recognized that the additional assessment would be necessary so that unnecessary money would not be spent performing an on-Site disposal removal, and then at a later date as a result of the remedial process, potentially performing an off-Site disposal remedy.

- **The Group's proposed alternative on-Site disposal remedy will create a public park with other environmentally beneficial features.**

EPA acknowledges this comment. EPA will support the creation of a park in addition to the Selected Remedy. EPA, DOI, and the City of Rossville are in favor of a park as future land use and will coordinate with the Group in implementing such a community benefit.